ROYAL COMMISSION ON HEALTH SERVICES

CANADIAN ECONOMIC GROWTH

T. M. BROWN

1964

CANADA

ROYAL COMMISSION ON HEALTH SERVICES

CANADIAN ECONOMIC GROWTH

1964

T.M. Brown

(Including Population Projections
by A. Stukel)

Publication of this study by the Royal Commission on Health Services does not necessarily involve acceptance by the Commissioners of all the statements and opinions therein contained.

Available by mail from the Queen's Printer, Ottawa,
and at the following Canadian Government bookshops:

OTTAWA
Daly Building, Corner Mackenzie and Rideau

TORONTO
Mackenzie Building, 36 Adelaide St. East

MONTREAL
Æterna-Vie Building, 1182 St. Catherine St. West

WINNIPEG
Mall Center Bldg., 499 Portage Avenue

VANCOUVER
657 Granville Avenue

or through your bookseller

A deposit copy of this publication is also available
for reference in public libraries across Canada

Price: $3.50 Catalogue No. Z1–1961/3–1/3

Price subject to change without notice

ROGER DUHAMEL, F.R.S.C.
Queen's Printer and Controller of Stationery
Ottawa, Canada
1965

TABLE OF CONTENTS

Page

APPENDICES

PREFACE

This study is an attempt to analyze and to project the economic growth of Canada. It was designed to serve as an economic background for the explorations of the Royal Commission on Health Services into the health needs, requirements, demands and resources of Canadians. It is a study in fairly broad aggregates, and refers to leading industries and products only in a general way. But its theoretical base includes in an essential way the idea of leading products and industries. The study begins with an excursion into the area of general theory related to development, growth and employment. I was especially interested in exploring the theory of a connection between these areas, mainly out of concern for the recent and possibly recurrent unemployment problems facing the Western economies of North America. Unemployment, particularly if it is heavy, involves substantial economic losses to society. But its toll in wasted human lives must be counted as much greater than this. The majority of the unemployed cannot be blamed for their plight, for this arises from vast social, economic and technological forces against which the individual by himself is powerless. But society as a whole can hope to deal with these problems if it has the will to do so. Society faces two challenges, which are also of the nature of moral imperatives.

The first of these is to create conditions which enable the unemployed to return to the self respect and dignity of participation in the nation's production, while their families share adequately, and without stigma, in the nation's consumption. The second imperative is to set about removing poverty and its *causes*, both internally and internationally through the pursuit of adequate sociological and economic policies.

The world in which we live is in a continuous evolutionary process, changing not only the forms of life but also the forms of socio-economic systems. Man has a chance right now to influence the evolution of the latter. The great struggle in the world today is between the democratic and the totalitarian ideology and political economy. In the former the individual is free to make political and economic choices within an environment created by the state – a state which is his servant, and which he can change. In the totalitarian world the state takes over the main political and economic decisions, as well as creating the environment. The state is the master of the individual, and can only be changed with extreme difficulty.

If the democratic societies are to survive as the "fittest", which in the short run can sometimes mean the strongest, they must be strong. But they must also develop and improve their systems until they will win the minds and hearts of men everywhere, especially in the newly evolving and less developed nations. Unemployment, instability, slow growth and poverty will win neither trials of strength, nor a following among the uncommitted countries. Yet our democratic societies permit these conditions to exist within the environment which the state provides, and within which free men are supposed to act. It is not that our societies approve or condone such defective functioning of our system. It is just that we have not as yet seen fit to tackle the solutions to these problems with the same vigor and resourcefulness which we have applied to unlocking the secrets of the atom, or to exploring the mysteries of space.

And so we return to some of the basic questions in our study: What are the determinants of economic growth? What are the determinants of employment? Are these in some way related? With regard to the last question, our analysis and empirical studies both suggest that there is indeed a mutual interaction between growth and employment. We cannot reach our optimal growth path in terms of both level and growth rate if we are suffering from unemployment. Conversely we cannot achieve continuing high level employment easily, and even in the short run, unless we understand the longer range growth forces which are present, and adapt our employment policies to them. Why is this so?

The employment theory of the past has tended to say that full employment can be reached by expanding final demand, and that any demand will do. We may expand consumption, investment or government expenditures. Our growth theory suggests however that we are unlikely to achieve our objective if we encourage the wrong form of final demand – any form which is inconsistent or at cross purposes with the growth situation and the investment opportunities of that period. Indeed it is this latter point which leads us to the conclusion that detailed industry studies are necessary tools to assist in the over-all formulation of policies aiming at sturdy growth and high employment.

In serving the purposes of the Royal Commission on Health Services, I was interested in providing background for questions on the extent to which economic growth would enable Canada to afford expanded health services, without displacing other services, should we as a wealthy society decide to move more rapidly in this direction. The analysis in this study suggests that we can indeed expand these services out of expected growth, without displacing any of our other present wants. It also suggests that if we proceed with such a programme from a position of unemployment, and possibly slow growth, that the programme itself will contribute to a more rapid rate of economic expansion and to a higher level of employment as well as solving many of our health problems. Rare is the policy which works on three major problems at once!

I based my economic projections on an indepedent study of population projections for Canada, 1961 to 1991, undertaken by Dr. A. Stukel, Senior Statistician in the Central Mortgage and Housing Corporation and Lecturer in Advanced Statistics at the University of Ottawa, included in this Report as Appendix E.

This particular economic study was set up at the advice of Commissioner O.J. Firestone, of the Royal Commission on Health Services. He wanted the background economic analysis to be both empirical and econometric. I have tried to do both, and I would like to express my appreciation to Professor Firestone for encouraging the econometric work. It was indeed he who organized the formation of an econometric research project in Canada in 1947, under the initial guidance of Dr. Lawrence R. Klein. It was in this project that my career in econometrics got under way. I am grateful to Professor Firestone who has acted as editor of this volume, for past encouragement and for his advice throughout this project.

I would also like to express my appreciation to our Chairman, Mr. Justice E.M. Hall of the Supreme Court of Canada, for his continuing interest in and support of the economic side of the Royal Commission's studies.

I am also grateful to our Research Director, Professor B.R. Blishen, now at Trent University, Peterborough, for his understanding and co-operation with this study and for a smooth-running co-ordination of it with the various related studies.

The Dominion Bureau of Statistics and the Department of Trade and Commerce gave assistance and advice on the assembly and processing of the massive quantity of statistical data which went into this project. I am grateful for their assistance, but I alone am responsible for the final form in which the results appear.

The handling of manuscript and statistical tables is a bulky operation in a study of this kind, and to Mrs. Helen Roney and the secretarial staff of the Royal Commission on Health Services, I extend my warm appreciation for their cheerful and efficient work, including much of the proofreading of the final results.

Finally, I would like to thank my son Garry, now a student in Mathematics and Physics at the University of Toronto, for invaluable help during holidays over two years. This study owes a great deal to the cheerful, untiring, neat and careful work done by Garrv.

T. M. Brown

June 1964.

Queen's University,
Kingston, Ontario.

CHAPTER 1

PURPOSE AND PLAN

This Study is an analysis and a projection of Canadian economic growth. Its purpose is to serve as broad economic background for the analysis and projection of demand for and supply of the services provided by the health industry in Canada. To achieve this we study the behaviour of the economy as a whole, but also any changes in the pattern of final demand which suggest a shift in public preferences reflecting potential expansion in the demands for health services. As we learn more about actual and potential economic growth of the global economy and improvement in the Canadian standard of living we also acquire some ideas about our increasing ability to pay for expanded health services without detriment to other goods and services currently desired by Canadians.

Our project begins with a brief and general examination of the nature and theory of economic development and growth (Chapters 2 and 3). Following this we attempt an analysis of possible and likely causes for the recurrent interruptions of sturdy growth at high level employment in the wealthy and mature economy (Chapter 4). This leads us to the difficult but vital area of appropriate economic policy for high employment and continuing economic growth (Chapter 5). Here too we look for the possibility of any connection between such policy and expansion of health services.

With such theory and policy considerations as background, we then set out a brief statistical-historical record of Canadian growth from 1926 to 1961 (Chapter 6). With these data we can test in a rough and impressionistic way, some of our earlier hypotheses and theories, and at the same time obtain a broad picture of how the Canadian economy behaved and grew over this period of 36 years.

We next combine data with theory in a more formalistic way to derive three models of the behaviour of the economy. With these models we project into the future the trends observed in the past. Three separate projections are made, one with each of the models (Chapters 7–10).

The models are of increasing order of complexity and detail. Each attempts to reduce the vast and detailed economic system to a small number of key variables which are deemed crucial in the growth process. It is the estimated quantitative relationship or relationships among these variables which constitute the

model. These relationships acting and interacting together reflect the mechanisms and the rates with which each variable in the model affects the other variables.

To anticipate our story somewhat, there appears to be a considerable growth potential in the Canadian economy. But whether we shall achieve this potential depends on our wisdom, will and skill in devising and implementing appropriate programmes of economic policy which will achieve both stabilization of the economy at high level employment and adequate growth. Our analysis suggests that these two goals are not unrelated.

If the attainment of these goals appears to be within reach we must decide, as a democratic society, how we shall want to allocate our higher and growing standard of living. For economic resources in a sense are like a putty or plastic, are a basic value stuff, which can be moulded, within reason, and with the help of science and technology, into whatever final forms society most desires. It would appear that we are now beginning to give a higher place in our social preference system to the health services, as our economy becomes more wealthy and more mature.

CHAPTER 2

CONCEPTS OF ECONOMIC DEVELOPMENT AND ECONOMIC GROWTH

Introduction

Growth theory is still in its infancy, although it has a magnificent classical foundation, associated mainly with the name of Ricardo [7, 81]. The members of the classical school however tended to take a dismal view of growth prospects. They were too much influenced by the concept of diminishing returns and the stationary state. For them the resource base was fixed, and technology limited. But the modern world has seen both the resource base and technology forever expanding under man's ingenuity. We have had a long period of experience with *increasing returns* in many industries, and are more inclined now to build this concept into our growth theories. There is accordingly much greater belief nowadays, fostered by scientific and technological advances, translated into material achievements, that man can have continuous economic growth, and can exercise considerable control over his economic destiny, while still maintaining democratic freedom. But to achieve this he must do much more scientific research on the workings of his economic system, and then apply his findings intelligently.

In presenting a modern picture of economic development and growth, this author cannot make any claims to completeness. Growth theory, as we now understand it is a field of recent origin, and the bulk of the developments are post-Keynesian. Thus, within the limitations of its terms of reference, this study attempts to sum up the main features of theory as it has developed and then apply the theory to the Canadian scene, to achieve the objectives of this investigation.

Three major contributions, all pre-war, open up the modern phase of our field. The first was Colin Clark's trail-blazing study first written in the latter part of the 1930's [13]. It can be thought of as relating to the theory of economic development. The second was a book by Eric Lundberg in 1937 [55]. The third was a seminal article by R.F. Harrod in 1939 [33]. The latter two works begin the modern study of growth.

Since World War II the interest in development and growth theory has quickened. The impetus to the study of economic development came on one hand

from a realization by the less developed countries of their poverty and backwardness in comparison to the rest of the world, combined with a new feeling that something could and should be done about it. (As far back as 1933 Erich Zimmermann had written [88 p. 807] "... the "outs" will not stand by idle, and hungrily watch the "ins" feast... rising nationalism will trample down vested rights; the Orient will try industrialization or die in the attempt... "). As a modern postscript we might add that hungry men do not care much about ideology, but only about what will promise the quickest results. On the other hand the more developed or mature areas of the world began to take an interest in these countries partly on humanitarian grounds, and partly because of the cold struggle which began to develop between the democratic and totalitarian worlds. Could the less developed nations be influenced to draw closer to one group or the other by economic aid, and by persuasion regarding the merits of the opposing social, economic and political systems?

The theory of economic development is vitally important to the less developed countries, and to the cold struggle which involves these areas, and ultimately all of us. For economic development is by no means an easy process, especially for an over-populated country. And without adequate theory and appropriate practice economic and social programmes may fail, bringing disillusionment and setbacks in their wake. But this theory is also important to the more mature economies, since development continues to be an important component of their own growth processes.

In this chapter we attempt to discuss mainly the development concept, but in relation to growth. In the next chapter we attempt to deal with the more aggregative and inclusive concept of growth. Before we proceed with our brief discussion of what is really a very big subject, it may be well to attempt a definition of what we shall mean in this study by the term "economic development".

Definition of Economic Development in Relation to Economic Growth

In the terminology of this field the term "development" was used more in the early literature, while the term "growth" has been used almost exclusively in the last decade. One also notes what appears to be a tendency to use the term "development" in relation to the underdeveloped areas, and "growth" with regard to the more mature countries. Development was used initially with the connotation of the stages of transition from primitive, mainly agricultural, production, to the full use of modern science and technology. Growth on the other hand was used to imply the expansion of output, or of output in relation to population or to labour input. Growth can occur with or without "development", and is consequently the term with the wider meaning. This presumably explains the recent shift to the more comprehensive term. However, this writer still finds the term "development" to be useful as an analytical tool, and so makes considerable use of it in this study.

Perhaps we can capture the spirit of what is meant in these terms, and make them more precise for analytical use if we define *development* in an economy to mean the infusion and the incorporation of science and technology into its

methods of production, accompanied or followed by *major changes in the pattern of its industry*, with a consequent rising and more variegated standard of living. Used in this sense, development is most pronounced in an economy's history, in the stages when it *begins* to absorb a technology based on science, and to enter an "industrial revolution". In Rostow's excellent delineation of stages in the process [72], the economy reaches *maturity* when it has absorbed and is applying a large proportion of the latest available science and technology. But development can then continue in lesser degree throughout its subsequent history after reaching maturity. It may even experience further sharp changes as new major discoveries and inventions occur, when entrepreneurs convert these into innovations [74].

Beginnings of Economic Development

An underdeveloped or less developed economy in the modern sense is usually one in which some or all of the following conditions hold: the predominant industry is agriculture, or some other extractive industry; the man-land ratio is often excessively high; the availability of knowledge about the physicial world and its manipulation for progress is exceedingly low; there exist poor general health conditions, frightful diseases are prevelant, and average life expectancy may be as low as thirty years; the prevailing ethos of the society favours the perpetuation of ancestral institutions, traditional ways of thinking and doing; average real income is very low, and poverty is widespread but there is a small and wealthy ruling caste.

If a society is to move out of its condition of underdevelopment, each of the conditions above must be changed; in fact a trend of change must be set in motion. But the combination of poverty and the traditional ruling caste combine to make a break-through into development exceedingly difficult and unlikely. For the improvement of techniques in the existing industry, and the creation of any new industry requires changed ways of thinking, and usually considerable quantities of capital goods. To build the capital goods, assuming sufficient knowledge, would first require extensive saving out of income. However it is very difficult or impossible for the poor of the society to save. Only the ruling caste can do this. Yet they do not want any process of change set up, whether of thinking or technology. Nor do they as a rule invest their savings in productive capital in the sense used here.

Rather their savings go into palaces, jewels, temples, mausoleums, and instruments of war – investments which perpetuate their system [47], and which are hence 'productive' from their point of view. Or, some of their savings may be placed abroad for safekeeping just in case the existing system cannot be maintained.

Recent international and internal disruptions (e.g. World War II and aftermath, and a wave of nationalist feelings among the less fortunate people of the world) coupled with the shrinking space-time of air travel, and the spread of communications in its many forms, have broken through the traditional systems of most

societies in every continent. Economic and technical aid, increased educational and health services given through the United Nations and by other means, as well as national efforts have helped to give people in the less developed countries the opportunities to strive for further improvements and for significant social change. The desire of these societies to follow the example of economic progress of the developed nations has created the intense interest on their part for economic development. The process is slow and painful, for the traditional system does not die easily. But once the *desire* is there, and the hold of tradition and the ruling caste are sufficiently weakened, the development process can begin.

The society must now start to accumulate knowledge, science, technology, management and organizational skills, with the help of the more developed countries, and apply these to its methods of economic production. Productivity (real output per man, per man-hour, or per unit of resource input) which has remained relatively constant for ages begins to increase and carry the level of real income up with it. But the nature of production is such that most major improvements in methods of production require new *tools*, often of the kind that harness the great power of non-muscle, inanimate forms of energy. To buy or build these capital goods requires that a portion of the real income generated in any period be not consumed, but diverted to investment in these goods.

Yet incomes at the very beginnings of development will usually be too low to generate sufficient saving to match the needed investment. Progress can accordingly be only very slow in these initial stages, unless outside help is forthcoming. At least this is generally the case. England and Japan, however, are notable examples of countries that were able to get development under way from their own internal savings. But it took England several centuries to reach "take-off" and then move to "maturity" [72]. The United States and Canada on the other hand telescoped the process considerably through the use of savings from countries (mainly England) that had already reached maturity, and had surplus savings.

This reflects a high degree of complementarity between the developing and the mature economies, with respect to saving and investing. In the former consumption needs out of new income are pressing, and the supply of saving tends to be too small relative to expanding investment needs. The reverse situation may develop in a mature economy.

In the international scene of today time is more pressing. Underdeveloped countries must get outside help as did the United States and Canada, if they are to speed up their development programmes. At whatever pace they can accumulate knowledge, technology, skills and the ethos of economic development, their parallel investment needs should be matched by whatever supplementary saving is necessary from the outside world – not only on the grounds of good economic sense but also on the grounds of morality and humanity, and perhaps of the peace and survival of the human race.

Given the changes outlined above, and outside help to accelerate the process, development can move at an improved pace. But one of the obstacles to development mentioned above may still provide a major barrier. This is overpopulation in relation to resources. Under this condition many would-be workers

are doomed to unemployment or underemployment (disguised unemployment) since their marginal productivity at work would be zero or negative. Labour is out of all proportion to land and capital. This condition generates untold misery, frustration, and very low average incomes. It produces a cheapening of human life and a lowering of the value of the individual. It is unfortunately the situation in which most of the less developed countries of today find themselves. And if these countries are to succeed in their aims they must steadfastly attack this problem. A population programme or policy is needed to accompany the economic development programme. The development programme must attack one side of the problem by increasing the land and raw material resources and the capital stock with which labour works. The population programme must attack the other side of the problem and study possibilities of redeployment and education of population within the country, while at the same time encouraging a reduction in the birth rate.

Continuing Process of Development

In this section is presented a model of how development might begin and continue in a country in which overpopulation is not too serious. We begin by recalling that food production is the most fundamental economic activity in any society. Food becomes available to all in a mature economy in a manner which usually does not create major problems in its provision. But in the underdeveloped economy there is always an awareness of the urgency of food production, because 70 to 90 per cent of the workers are likely to be engaged in this area, and there is still ever present hunger and ever present danger of famine. This condition exists because of low productivity and large population. It is accordingly in agriculture that it is most logical to begin to apply the tools of development – science, technology, management.

The application of these tools will gradually increase agricultural productivity, and a surplus of labour will appear in this industry. At the same time agricultural incomes will increase, also as a result of the increased productivity. Savings will begin to appear out of the increased incomes, facilitating the capital investment needed to apply more modern technology. The demand for food, a basic necessity, will eventually become inelastic further accentuating the trend to surplus workers. This inelasticity will depress prices, reducing the return on capital, and slowing down the *widening* of capital (duplication of existing technology) but not necessarily slowing down capital *deepening* (improving technology using more capital per worker) if costs are thereby sufficiently cut. (This latter would be rather unlikely in an overpopulated country where the value of labour may be so low as to be almost a free service).

With surplus labour and saving the development process can now take its next decisive and vital step. *This is the creation of a new industry.* While the basis for the new industry is available factors and technology – *supply* potential – a prime requisite for this step is *demand*. The goods produced by the new industry must be highly desired. Further, incomes must have risen sufficiently in the economy to enable the goods of the new industry to be demanded. The goods

produced by the new industry must be such that the output from additional resources moving into the industry will bring greater social satisfaction than if the additional resources were used in producing food. Since many industries would satisfy this criterion, that industry with the greatest potential increase in social satisfaction should be selected. It will provide the greatest rewards to shifting labour and capital. Such an industry might be the fabrication of cloth and clothing, or the construction of vital social capital for transportation and education.

The important point to note now is that real income per worker or per unit of resources (team of labour, materials and capital) has gone up because of the new industry. The value of the marginal output of a unit of resources in the old industry was declining as inelastic demand and near saturation were reached. At the same time technology was creating surplus resources. But these surplus resources move into the new industry where demand is high and elastic. Their marginal productivity and incomes become higher than they could be in the old industry. National income (real) rises from both increasing employment and from increasing marginal productivity of resources. *Growth is occurring because of development.*

Now the tools for increasing productivity – science, technology, organization – can continue to be applied to the two industries. Incomes and savings will increase, but eventually inelastic demand and saturation will be approached by the second industry. All three of surplus labour, surplus saving and a market have now become available for the development of a third industry. Again it must be selected from a priority list as the industry which will yield the highest returns to a unit of resources. Again social satisfaction will be increased, the reward to labour and the profitability of capital and organization will increase, because of the high demand for the goods of the new industry. Growth is occurring because of development. Each industry in succession will tend to move along a sigmoid ($\int$) time profile, the upper asymptotes of which may shift upward as population and real incomes grow.

In the process of creating new industries out of productivity developments, market expansion and the reaching of market saturation in the old industries, a capital goods industry can be expected to develop. Up to this time it would probably be necessary to import most of the capital goods needed for the development programme. But capital goods become increasingly vital in the development programme, and the market for them grows. The expanding domestic market gradually creates the possibility for this industry. Also a country that takes great pride in its growing technological abilities may want to hurry this industry along. It may not relish the inferior position of always importing its technology from others. And since technology and capital goods are at the heart of any development process, it may not want to be at the mercy of other countries in this vital part of its industry. There are of course major military overtones here. The matériel of war and defence become increasingly scientific, and in some instances can only be produced by the most advanced economic systems.

At this point we may mention the likely growth of export industries in the development process. These industries are based on comparative advantage, and

their ultimate product is desired import goods. Their profitability hinges on comparative advantage and the terms of trade. Often developing economies find that industries which export raw materials are initially easy to retain or introduce, and are initially of sufficient profitability. But it is usually found that such industries are only significant as a step in the development process, and that if the process is to continue new industries with more advanced technologies must be added. Such industries may aim at the domestic market, export markets, or both.

A keynote phrase in the whole development concept is "*social profitability*". The essence of any economic production is the creation of goods of greater value than the cost of the resources used up. There is nothing gained in converting resources into goods of only equal value. The cost of labour can be considered to be the cost of subsistence (a historically relative term). To the extent that wages and salaries are above this cost, labour is earning a profit [1] on its human capital invested in education and skills. Profit is also earned on capital goods, and on enterprise or organization. This profit is computed on costs which are themselves at well above the "subsistence level" since part of the cost of producing material capital goods is the payment to labour *cum* human capital, the current wage-salary bill involved in producing the capital goods. And the total return on capital is based in part on its cost. In a team or unit of resources the composite profit earned can be called "social profit". Economic development permits "social profitability" to keep forever increasing. Wages are never driven back to a bare subsistence level, and a stationary state never need be reached. These conditions – subsistence and the stationary state – could be expected to happen but for the advent of the new industry.

In the development process the product of each industry tends to pass through three stages of demand and profitability. In the first stage as the industry is born the product is a "luxury" with an elastic demand (e.g., the automobile). There are rewards to expansion of the industry. Expansion gradually brings the price down and the good is more widely used. Eventually it becomes built into the fabric of life in the society and has become, if not a subsistence need, at least a cultural need. At this stage fewer new users of the product are to be found, and the rate of growth of the industry starts to slow down or decrease. Demand becomes less elastic and eventually inelastic. The market has become saturated and only replacement demand is left. The industry may stop growing at this point, and adjust itself to satisfying replacement demand. If however the population and real income per capita continue to grow, the industry may still retain a modest growth rate. Its life cycle or time profile has followed the familiar sigmoid pattern mentioned above, but its upper asymptote may continue to shift upward with growth in population and real income.

One warning is necessary however with regard to this assumed widening of the market. Social profitability and incomes must be reasonably distributed. Under complete *laissez faire* in this regard, vast differences in human skill, plus the effect of compound interest on capital ownership, soon create a very uneven or

---

[1] The term "profit" is being used here in a rather broad sense, to include all earnings above "basic" costs. It thus includes all of the economists' concepts of interest, rent, quasi-rent, and pure profit.

skewed income distribution. Unless checked by inheritance taxes, progressive income taxation, welfare programmes and free education (this latter helps redress the distribution of human capital), the development process might grind to a halt. The mass markets, on which the social process of developments depends, might gradually dry up; and social unrest might follow effecting the basic foundation of the economic and political system.

Our theory also leads us to deduce that the rate of profits in the old industries will reduce toward some minimum (the rate of interest on money, plus some allowance for uncertainty) as market saturation and inelastic demands are reached. Resources are thereby pushed from the old, and drawn to the new. At the same time we deduce that the *relative importance* of the old industries in the total industrial pattern will continue to decline. Thus as development proceeds agriculture may decline from 80 per cent of the value of total production to 10 or even 5 per cent. Manufacturing may in the process increase from nothing to 30 per cent. Currently *its* relative importance is starting to decline in favour of the service industries, in the most mature economies.

In a country which is developing late in relation to more advanced countries, innovational possibilities are always available to be copied from the more developed economies. But once such a country has caught up to the others, in the sense of having absorbed all of the existing technology available abroad, its rate of development must slow down. It can still continue to develop, but now it must await the new discoveries and inventions on which further development will depend.

Growth in the mature society can come from new scientific, managerial and organizational discoveries occurring both inside the society, and in the outside world. These can continue to improve the productivities of all existing industries. But development in the mature society requires major discoveries and inventions, with new demands and major innovations. Only these can create the new industries, or alter existing industries drastically, on which development depends.

In this connection, Schumpeter [74] has stressed the vital role of the innovator. In our discussion so far we have subsumed the presence of innovators, the dynamic people who lead the society through the necessary changes in economics, technology and social attitudes and ethos. Even in the mature society the innovator is vitally necessary if development is to continue.

Examples of recent innovations producing new industries in the mature societies are: television, electronic computers, automated machinery, atomic energy, space exploration.

It can be observed from even this recent list that the innovations behind development can occur on both the *demand* and the *supply* sides of the economy. On the demand side the innovation will involve, as we have already analysed, an important new product which consumers will desire very strongly. But what is the nature of innovations on the supply side?

These arise from discoveries which revolutionize the production of goods already desired and demanded. The cost of production is now dramatically reduced

and output is gradually expanded, especially as the imitators [74] swarm into the field. Before this can happen however, the innovator can reap an abundant profit as reward for his daring and initiative.

In order for the expansion of output to occur on a large scale there must be sufficient price and income elasticities of demand. (Cf. the Henry Ford story, providing a good example where these elasticities were high. The supply innovation in this case included the assembly line and other mass production techniques.)

The Industrial Revolution in England began with supply innovations. The final goods involved were cotton and wool cloth. Markets included both the domestic population and many foreign countries. The main inventions which lifted the production functions for these goods to undreamed of levels were the Spinning Jenny, Mule, Cotton Gin, Power Loom, and finally the ubiquitous steam engine. Productivity rose and costs fell dramatically. The markets had sufficient breadth and demand was sufficiently elastic. The process, the revolution, was on its way.

Note that many of the major innovations on the supply side have required vast investment in new capital goods. This is true of most development, whether it arises on the demand or the supply side of the economy. A capital goods industry ultimately becomes vital in the developing and maturing process. In our model of development, industry must now expand at two focal points. One is at the production of the new capital goods which are a major part of the revolutionary new technique. The other is at the expansion of the original industry, as the price of its final product is brought dramatically down and its output enjoys a great expansion. The increased employment, incomes and profitability now come about from producing the new capital, and from the increased productivity and the cost reduction in producing the final product desired. This new productivity is of course created by the new physical capital, and by the labour skills and knowledge (human capital) which creates and operates the new techniques.

To sum up our discussion of "demand" development versus "supply" development we may observe that, in the former, profitability arises because demand for the new product is strong relative to supply, and hence price, for a time, is well above cost of production. But in the case of "supply" development, supply expands relative to given demand through cost reducing innovations. In the short run price is well above the cost of the innovator. Simultaneously demand usually starts to expand in the capital goods industry.

The big innovations of the last two centuries can be classified as "demand", "supply" or "mixed". They include those mentioned above related to the production of cloth, followed by the developments in iron and steel, the steam railway in transportation, the generation of electricity and its use in industry and the home, the automobile, radio, television, electronic computation and automation, atomic energy and space engineering.

Each of these innovations has required a new kind of capital equipment, and we have both gradual and sharply discontinuous changes in the character of our stock of physical, productive capital.

In recent times in the mature economies some parts of manufacturing have seemed to be approaching the stage of saturation of demand – especially in durable goods. A society reaching this stage has become wealthy indeed, and can be aptly called an "affluent society" [106]. In these societies no new manufacturing industry has yet appeared which has sufficient need for labour and capital to absorb the inevitable surplus of labour, capacity and savings generated by maturing industries as these saturate their markets and continue to make productivity gains. This becomes one of the major problems of the mature and wealthy economy. How does it maintain vigorous growth with stability, at full employment? This is essentially the problem studied in Chapter 4.

Part of the solution to this latter problem is made by a shift of demand and employment into the service industries. This shift is already observable on a considerable scale in Canada and the United States. It represents the last stage of economic development which history has so far revealed to us. This shift is of course of great relevance to the present social interest in health services.

Role of Government in Economic Development

It is now generally agreed by most social scientists that government is needed in a free and democratic economy to guide the economy toward the economic goals of the society. In economic development government must indeed play a crucial role. At the outset it must provide vital social capital in forms like roads and harbours, social services like education and public health, and improved laws, business practices, and communications. In later stages there can be problems of unemployment and loss of wealth as old industries are stabilizing and new industries are just beginning to appear on the scene. Government can help to foresee these transition periods, and both speed them up and remove much of the hardships.

In subsequent chapters we consider again the role of government, especially in relation to growth problems and the goal of full employment.

Conclusions

Economic development is the key to man's escape from the vicious circle of poverty, and from the economist's spectre of diminishing returns, subsistence wages and the stationary state. (With the proviso that account must be taken of the problems created by over-population.) It begins with new attitudes and with education. It proceeds by a sequence of developing industries, with each new industry arising out of new knowledge, but only made possible by an increase in productivity in the older industries. This releases economic resources for the new industry. The innovations which generate the demand for the new industry may arise from the creation of a highly desired new final product, or from the discovery of a new technology for producing existing products. In the latter case the new "industry" forms in the capital goods sector.

It is the high initial profits of the new industry which generate its growth, for it is these which draw in new firms, and induce the earlier entrants to expand. The growth of the new industry increases the general welfare and progressively eliminates the super profits.

As development proceeds its outward and visible signs become apparent in growing real incomes, a widening and more variegated range of goods open to the society, and a higher proportion of income saved.

At this point we can close the circle of a mainly endogenous theory of development and growth. It is merely necessary to add to our analysis that growth in real income makes possible and facilitates the expansion of research and the development of knowledge. And it was knowledge, interacting with economic motives, which was the essential starting point of our whole process of development outlined above. This dynamic growth mechanism, a mutual feed-back interaction between knowledge and economic forces, can continue forever, as long as the channels to knowledge are kept open.

The mature economies of today have passed through development of the primary extractive industries, the secondary, transformative manufacturing industries, and now perhaps enter an era of the service industries. With this phase we envisage the possibility of great welfare and health improvements and a vast widening and deepening of the cultural services – education, philosophy, religion, the arts, travel, entertainment and recreation, With this phase man at last may succeed, through a wise materialism, in escaping from the grasp of materialism; through having mastered the means of life, at last to learn and apply the ends of life. In this way we may be able to escape the problem Rostow raises of "secular spiritual stagnation" [72]. But we still must pass Rostow's pair of lions – modern weapons of mass destruction, and the paths yet to be taken by the newly developing nations. These problems are all related, and our time is short.

CHAPTER 3

THEORY OF ECONOMIC GROWTH AND GROWTH POTENTIAL

Background and Preliminary

Modern theories of growth, as distinct from the classical theories are of fairly recent origin. They are intertwined with theories of economic development, with little attempt made explicitly to sort out any differences in meaning between these two concepts. They have followed closely on the heels of the Keynesian theory of employment [92]. It turns out that the growth and employment theories are essentially complementary. If we wish to plan for *continuous* full employment, as distinct from full employment *today,* we must combine our growth theory with our employment theory. (Cf. Chapter 4 below.) Conversely if we wish to stay on our highest potential growth path we cannot tolerate unemployment.[1]

Three seminal writings are the main progenitors of what may be called the modern theory (or theories) of growth. These are the celebrated works of Lundberg [55], 1937; Harrod [33], 1939; and Domar [18], 1946. The children of these parents are now numerous, and continue to grow and multiply. The theory is still developing rapidly, and is still in a state of ferment. It has probably reached the stage where basic hypotheses and their deduced consequences should be more thoroughly tested with empirical data. Progress is beginning to appear in this direction.

It is in this latter field that the present study hopes to make its main contribution. Both an empirical and an econometric study of the growth of the Canadian economy appear in later chapters. These studies are then used as the bases of long-range projections of the future growth of the Canadian economy.

The present and the next chapter are devoted to a presentation of some of the highlights of modern growth theory, and its relationship to employment theory. Selection is on the basis of fundamental concepts, and of relevance for the purposes of projection. This brief theoretical background provides a basis for looking at the recent statistical-historical record of growth in Canada in Chapter 6, and for model building and projection in the subsequent chapters.

[1] Except for a minimum amount due to frictional, seasonal or related causes.

Meaning of Growth and Its Relationship to Development

In the preceding chapter we attempted to define the meaning of economic development. In this chapter we do the same for economic growth. Development was analyzed to mean the widening and diversification of the industrial pattern of a nation, accompanied by a rise in the standard of living and an increasing variegation in the choice of goods and services available to the public. To analyze the process of development we set up a model of how the process might occur. As Rostow had shown [72] it was necessary to disaggregate at least to the industry level to understand this process.

Growth on the other hand is superficially a simpler concept. It merely means an increase in the gross real production and income available to the residents of a nation – an increase in its real Gross National Product (GNP). Clearly development produces growth, as long as the development is not wasted by unemployment. But growth can occur from a variety of *other* causes, without the dramatic processes of development taking place. Growth can be studied from the above simple point of view without disaggregation, although disaggregation may be needed to understand its basic causes.

What are the possible causes of growth, other than the occurrence of development? Firstly we can think of a *growing population*. As long as a fixed proportion of the population is at work, a growing population will tend to create an increase in GNP. It is merely necessary that the marginal productivity of workers be always greater than zero to assure that GNP will increase. The marginal productivity of workers will be greater than zero if they are in appropriate proportions to the availability of natural resources and capital equipment. To maintain this situation with a growing population it will eventually become necessary to expand existing technology. This must be done to keep capital facilities and materials in balance with the working population. This *widening* of capital also causes GNP to increase, and hence creates growth.

Growth in GNP can occur on a similar basis if a larger proportion of an existing population becomes employed, or if the society decides to work longer hours. Thus if the labour force participation rates, or the employment rates of the labour force, or average annual hours of work increase, we can expect an increase in GNP.

There is one further source of economic growth which is somewhat related to development, but which is less spectacular in nature and in magnitude. Also it is not associated with the creation of new industries, or of new products of any great significance. This growth arises from the fairly steady accretion of advances and improvements in education, workers' skills, managerial skills, and administration; and from the myriad of lesser scientific and technological discoveries, inventions and minor innovations which occur year by year. It depends further on the spirit of the people engaged in the productive system – on their health, morale, zeal, social purposes and values – from which derive their intensity and effectiveness of effort. This heterogeneous collection of sources of economic growth can be summed up under the term *socio-technical progress*.

In the underdeveloped economy, development will clearly be the major source of its potential growth. In the mature economy development can still occur and act as a source of its economic growth – witness the recent new industries and products related to television, electronic computers, automation, atomic energy, space. But perhaps the main sources of growth in the mature economy are represented by the increase of population, the widening of capital, and by socio-technical progress.

Symbolic Representation of Growth and Its Causes

The above list of sources of economic growth is not complete. However before attempting to add any refinements, it is worth while to summarize our position and clarify our concepts with the aid of mathematical symbols. Suppose we let O = the aggregate output of the economy. This could be represented by GNP. However for production analysis it is better to use the closely related concept of Gross Domestic Product (GDP), the rate of output of goods and services (in real or constant dollar terms) within the geographical boundaries of the economy.

Any increase in O can be defined as positive growth. The instantaneous rate of change of output is the time derivative dO/dt, where t = time. If t is in units of one year, and O is the aggregate flow of goods (including services) in one year, then the instantaneous annual rate of growth of output is:

(1) $\frac{1}{O(t)} \frac{dO(t)}{dt} = {}^{\cdot}O(t).$

In terms of finite rather than instantaneous differences, we define

(2) $\Delta O(t) = O(t) - O(t-1)$. Then

(2a) ${}^{\cdot}O(t) = \frac{\Delta O(t)}{O(t-1)}$. Expressing our growth rate as a percentage rate of growth per annum, we have

(3) ${}^{\circ}O(t) = {}^{\cdot}O(t) \times 100.$

Let us now express output and growth in terms of the causes outlined above. Let N = total population, pr_1 = average rate of participation of population in the labour force, er = proportion of labour force employed, or employment rate, h = average annual hours of work per worker, K = stock of materials, and capital equipment used in the productive system. Then the current technology can be represented by a production function which relates the rate of output to the average use of factor inputs, labour and capital, within a time period t.

(4) $O(t) = f_t\,(N_t . pr_{1t} . er_t . h_t, K_t).$

If we consider land, the total natural environment, to be a relatively constant factor of production, then it can be considered to be included within the functional form and parameters represented by f_t.

The number of employed workers in the productive system can be abbreviated to $N.pr_1.er = N_{peg}$ = number of paid workers, private sector, plus number of entrepreneurs and unpaid family workers, plus number of government employees = total number employed = N_e. Labour input into production is total man-hours of work = $N_e h = L$. Our production function can now be abbreviated to

(5) $O = f(L,K)$.

Our formulas express the concept that real output can increase or grow because there is growth in labour input L, or in reproducible, tangible capital input K. Labour input grows if there is a net increase in the product $N.pr_1.er.h$. Capital input will grow if new gross investment GI is greater than capital consumption or depreciation D. For $K = K_{-1} + GI-D$. K is based on a simple cost of resources concept. Increase in the productivity of new additions to K relative to that of older investment must be taken care of by the rate of depreciation (which includes absolescence) and by the functional form of f_t.

But there are two other sources of growth which we have not yet specifically designated in our formulas. These are development, and socio-technical progress. On reflection we see that both of these will tend to change the shape and especially the *level* of the production function. We may recall here Schumpeter's definition of an innovation, as an alteration in the processes of production which changes the related production functions [74 vol. 1]. We would expect that development would produce large and rather sudden changes in the aggregate production function, while socio-technical change might produce a slow and steady lifting of the function.

It turns out that we have allowed for these two sources of growth in our production function (4) above, by placing the time subscript on the function f, as well as on the variables. For statistical and econometric work however it may frequently be necessary to assume a constant basic functional form. When this is so we can apply either a multiplicative or additive factor to the constant functional form to represent the combined influence of development and socio-technical progress. Thus

(6) $O(t) = A(t)\ f(N_{et}h_t,K_t)$, or

(7) $O(t) = f(L_t,K_t) + A(t)$.

The factor A, which combines the effects of development and socio-technical progress, will henceforth be referred to simply as *technical progress* for short. This factor was used in its multiplicative form in the studies by Urquhart [84] and Solow [79].

In fact there is much to recommend formula (6) as a preliminary simple description of real world processes in the mature economy. At the heart of technical progress is knowledge and skills, which become embedded in human beings as human capital. As knowledge and skills accumulate through time the marginal productivity of labour increases. At the same time capital goods evolve into ever more productive forms, though built from substantially the same basic materials and labour as before. Developing human knowledge and skills is of

course responsible for these improvements in capital, and in its marginal productivity. The production function (6) provides an elementary representation of these concepts.

Growth and the Relative Use of Factors

Formulas (6) and (7) above imply that technical progress is *neutral*, in the sense that, for a given price pattern of labour and capital, the progress does not encourage a substitution of labour for capital or conversely. (The proof for this is given as Note 1, in the Appendix to this chapter.) If the progress increased the marginal productivity of capital more than that of labour we would find a relative substitution to capital and away from labour. This would be a capital-using or labour-saving innovation. This is the kind of progress we would expect in the early phases of development, when the marginal productivity of capital becomes very high relative to that of labour.

To envisage this we need only think of the tremendous power achieved when inanimate energy is harnessed in modern machinery to carry out productive operations. Consider for example the modern power digging and earth-moving machinery, in comparison to a man with a simple shovel; a modern steel mill to an early smithy.

Thus we would expect an increase in the capital/labour ratio, K/L or K/N_e, in the early stages of development. Also since fixed capital is productive over a long period of time, we might expect the capital/output ratio K/O to increase.

Once an economy has become mature however, it is not so certain that innovations will be capital-using (labour-saving). At this stage large new innovations are more scarce, and in the meantime the marginal productivity of labour has increased substantially through advanced education and training. Now if there is substitution to capital and away from labour it is more from price effects than from innovations. This is because capital becomes relatively cheaper and labour more expensive in the mature economy which has a large volume of savings, and a high standard of living. At this stage innovations are likely to become more neutral in their effects, as the marginal productivity of labour may rise just as fast as that of capital.

The very recent fashion in growth theories to associate all technical progress with latest vintage capital [80] seems to ignore the equally rapid advances in the marginal productivity of labour and human capital. Labour education, skills and research is more *vital* in the *design* and *operation* of the latest technology and equipment than is the equipment itself, although both are ultimately complementary.

The effect of expansion of the service industries on the above ratios is not clear, for in these industries the marginal productivities of both labour and capital are high.

In Canada the K/O ratio is estimated to have fallen over the period 1926–1961 while the K/N_e ratio has risen (cf. Chapter 6). This indicates some, as yet

unknown, combination of changes in relative factor prices and possibly non-neutral technical changes. Since the ratio of average hourly earnings to the average cost of using capital has increased, and since K/O has fallen, perhaps what we have is roughly neutral technical change, coupled with the factor-price substitution effects.

In the absence of any further technical change in an economy, and assuming unlimited land, we can deduce, rather intuitively, as follows. If the net marginal efficiency of capital is greater than the interest rate (a disequilibrium growth situation), capital is scarce relative to labour, as a factor of production. Hence capital will tend to grow, *via* gross investment less depreciation, at a higher growth rate than labour. This will produce a *capital deepening* process, as both K/L and K/O increase. (It is clear that K/L will increase, and our subsequent formulas (11) and (12) reveal that K/O also will increase under these circumstances.) However, once the net marginal productivity of capital has fallen to the level of the interest rate, this deepening process will stop. In fact for zero growth rate of labour, we would have zero growth rate of capital stock, and gross investment would equal depreciation. The economy would have reached a stationary state, with all economic values repeating themselves period after period. But if labour has a constant growth rate, then capital must now grow at just this rate in a *capital widening* process. For if it grows at a slower rate, it will once again become a scarce factor, with net marginal productivity greater than the interest rate. This will cause its rate of growth to increase up to, but not higher than the growth rate of labour. Professors Swan and Solow demonstrate this kind of growing stationary state in their 1956 articles [81], [78].

Once labour and capital are growing at the same rate, under the conditions assumed above, then output will also grow at this rate (cf. formulas (11) and (12) below).

Horizontal, Vertical and Downward Growth

If real output grows at the same rate as population, with participation and employment rates and hours held constant, the population as a whole will not be better off. Assuming a fixed income distribution, the standard of living remains constant. This is of course the situation in the constant or the growing stationary state. Let us define this as *horizontal growth*, if participation and employment rates and hours are what the society would democratically choose as optimal. Such a growth path (the time graph of O, or of O/N) could be lifted to a higher level by increasing some or all of the participation and employment rates and hours. The growth rate would temporarily increase, but would then return to the population growth rate. The population would be no better off as a result of this change, since it would have traded leisure for goods at the old rate of transformation between these. Real output per man-hour (O/L) remains unchanged. We still have what we may define as horizontal growth. Our criteria of horizontal growth are then: constant average real output per man-hour; no change in economic welfare at given distribution of income.

Vertical growth can now be defined in an obvious way. It occurs when real output per man-hour ($O/L = p_L$) is rising, and the economic standard of living is rising. This can only happen when economic development and socio-technical progress are occurring assuming that labour, capital and the natural environment are in optimal proportionality (see below). Once technical progress has occurred, and A in (6) has increased, vertical growth can begin. Output starts to surge upward to a higher growth path. The marginal productivity of both labour and capital will increase. Capital now starts to grow at a faster rate than labour, because of the new disequilibrium situation.

Now let us assume that no further technical progress occurs. As capital increases relative to labour, its marginal productivity will gradually fall to the interest rate, and once again capital, labour and output will all be growing at the growth rate of population. The economy is once again in equilibrium. But it will now be on a higher growth path at a higher standard of living, as a result of the above single burst of technical progress.

Downward growth occurs when population grows faster than the availability of land resources, and faster than reproducible capital, so that diminishing returns to labour set in. Both the average and marginal productivity of labour falls, and the standard of living declines. To arrest downward growth it is necessary to bring population growth in relation to availability of resources, and to the rate at which the capital stock can be increased.

Vertical growth is of course what is desired by all countries who are below an optimum economic welfare level, assuming some optimal distribution of income. It is also desired by all countries who plan for offence or defence in the world political scene. Modern weapons are very costly, and require advanced technology. This puts a premium on vertical growth, in a modern evolutionary struggle, with survival of the fittest at stake, between democratic and totalitarian systems of political economy.

Our theory suggests that vertical growth can only be maintained in an economy if there is continuous technical progress.

Optimum Proportionality of Factors, and Growth

Production functions are very likely non-linear in reality, so that variation in each factor separately will cause it to pass through increasing, constant and finally diminishing returns. An optimal proportionality of factors is reached in a competitive model, and is such that average costs of production are everywhere minimized throughout the economy. Imperfect competition, and recession from high level employment, cause these conditions to be broken. Imperfect competition is an accompaniment of large scale mass production, which in itself fosters vertical growth. But a society can have even more vertical growth than that given by technical progress, if it can find ways of inducing minimum cost operations in the areas of imperfect competition, and if it can prevent unemployment.

Growth and the Size of the Market

Growth in population and in available markets can in themselves act as major causes of development and further vertical growth. Once a market has grown beyond some critical size, it becomes possible and profitable to introduce large scale methods of production [87]. Only a mass market can readily absorb a new output. The large market can also make it profitable to start up the production of new products, or of products formerly imported, which are of the nature that they require a large scale technology to attain a reasonable cost. Examples are the production of steel, automobiles, atomic energy. These developments create vertical growth through massive upward shifts in production functions and accompanying increases in average and marginal productivities.

Preliminary Mathematical Analysis of Growth

Suppose we begin our analysis with a situation where technical progress has for a time ceased, so that A(t) is constant. We proceed to analyze growth under this condition using formula (6) and its antecedents.

(8) $O = Af(L,K)$ For small changes and small time periods we have

(9) $\frac{dO}{dt} = A\frac{df}{dt} = A\left(\frac{\partial f}{\partial L}\frac{dL}{dt} + \frac{\partial f}{\partial K}\frac{dK}{dt}\right).$

(10) $\frac{1}{O}\frac{dO}{dt} = \frac{A\partial f}{\partial L}\frac{L}{O}\frac{1}{L}\frac{dL}{dt} + \frac{A\partial f}{\partial K}\frac{K}{O}\frac{1}{K}\frac{dk}{dt}.$

(11) $^{\cdot}O = y_L{}^{\cdot}L + y_K{}^{\cdot}K$ = annual rate of growth of output in terms of the annual rates of growth of labour and capital. y_L is the share of labour in total output, on the assumption that the marginal product of labour $\frac{A\partial f}{\partial L}$ is equal to the average real hourly earning of labour. Similarly y_K is the share of capital in output. Since output is fully shared between labour and capital, we have

(12) $y_L + y_K = 1$

With no technical progress $^{\cdot}K$ cannot continue to be greater than $^{\cdot}L$, since this would drive its net marginal product or rate of return down to and below the interest rate, under diminishing returns. Nor can $^{\cdot}K$ continue to be less than $^{\cdot}L$, for this will eventually raise its return above the interest rate, thereby causing its growth rate to increase. Thus $^{\cdot}K$ is inexorably driven to a terminal growth rate equal to $^{\cdot}L$. Then

(13) $^{\cdot}O = y_L{}^{\cdot}L + y_K{}^{\cdot}L = {}^{\cdot}L(y_L + y_K) = {}^{\cdot}L = {}^{\cdot}K$ (cf. Solow [78] and Swan [81]).

Let us call this terminal path a "turnpike" growth path, after Samuelson [5].

As we have previously analyzed, a single increase in A will lift O up to a higher growth path, but its terminal growth rate on this higher path will eventually be equal to $^{\cdot}L$ once again. We note that this conclusion has been reached

without any mention of saving and the saving ratio, and we must keep this point in mind as we analyze further.

In the real world of developing and mature economies we tend to have continuous technical progress. Let us now extend our analysis to include this situation.

(14) $\frac{dO}{dt} = A\frac{df}{dt} + f\frac{dA}{dt}$

(15) $^{\bullet}O = y_L{}^{\bullet}L + y_K{}^{\bullet}K + {}^{\bullet}A$ Note that, still for small changes and small time periods,

(16) $^{\bullet}L = {}^{\bullet}N + {}^{\bullet}pr_1 + {}^{\bullet}er + {}^{\bullet}h$

These formulas tell us that the rate of growth in output is a weighted arithmetic mean of rates of growth in labour input and in the stock of capital, plus the rate of growth of technical progress. The rate of growth of labour input is in turn a simple sum of the rates of growth of population, average labour force participation rate, employment rate and average annual hours of work.

The rate of growth in the average productivity of labour, which we have defined as a main indicator of vertical growth, is found by combining (12) and (15).

(17) $^{\bullet}p_L = {}^{\bullet}O - {}^{\bullet}L = y_K{}^{\bullet}\left(\frac{K}{L}\right) + {}^{\bullet}A$

This formula says that the rate of vertical growth equals the share of capital in output times the rate of growth of capital per unit of labour, plus the rate of technical progress. We have previously analyzed that K/L can increase only if there is technical progress. If there is no further technical progress then, in the long run $^{\bullet}A = 0$, $^{\bullet}(K/L) = 0$, and $^{\bullet}p_L = 0$.

A slighlty different combination of (12) and (15) yields the following result.

(18) $^{\bullet}O = {}^{\bullet}L + y_K{}^{\bullet}\left(\frac{K}{L}\right) + {}^{\bullet}A = {}^{\bullet}L + {}^{\bullet}p_L.$

The overall rate of growth of output for an economy is equal to its horizontal plus its vertical rates of growth. This is the formula which provides the basis of Projection Number 1 (Chapter 7).

Relationship Between Saving and Growth

In the growing stationary state with only horizontal growth occurring, the rate of saving out of total output seems to bear no relationship to the rate of growth of output. For the latter is equal to the growth of labour, and to this alone. But note that in this state investment opportunities are severely limited, for there can only be capital widening. Capital growth is strictly fixed at labour growth.

Let us now consider an opposite extreme, where there has been so much technical progress, that there is for a long while disequilibrium growth and unlimited investment opportunity. This is the case of the underdeveloped economy which is free to help itself to the previous technical developments of more mature economies, or of the mature economy into which drops a sequence of major innovations. What is the effect of the rate of saving in these economies on their growth rates?

To begin this analysis let us develop a simple dynamic process, in which a society with fixed population and labour force saves a fixed proportion s of its real gross output in each time period. We assume that this society still has good investment opportunities so that sO in each period is profitably invested in real capital, increasing the stock of capital by $\Delta K = sO-D$. Let us also assume that the marginal productivity of this capital is $\partial O/\partial K = r > i + sf$, the gross cost of using this capital in real terms. (This concept is amplified further below.) Our dynamic sequence of output now becomes

(19) O_o

$$O_1 = O_o + r(sO_o-D) = O_o[1 + r(s- dk)]$$

$$O_2 = O_o[1 + r(s - dk)]^2,$$

where $d = D/K$ = average rate of real depreciation of capital, and $k = K/O$ = capital/output ratio. We assume K_t to be the annual average or mid-period stock of capital. Note that $k = 1/p_K$.

Thus productive capital can generate a compound growth process, and this is of course the basis of compound interest. For instantaneous growth, with finite time periods, the growth formula switches from

(20) $O_t = O_o[1 + r(s - dk)]^t$ to

(21) $O_t = O_o e^{[r(s - dk)]\, t}$.

It follows that, as long as there are abundant investment opportunities arising out of technical progress, the savings ratio matters very much. The higher it is, the higher will be the disequilibrium growth rate of total output.

(22) $\cdot O = r(s-dk)$

Let us now see how formula (22) relates to (15), where we have growth in population and continuous technical progress, as well as a saving-investment process adding to the stock of capital. In (15), $y_K = \frac{\partial O}{\partial K}\frac{K}{O} = \frac{rK}{O} = rk$. Also

$\cdot K = \frac{sO-dK}{K} = sp_K - d$. Hence $y_K \cdot K = rk\left(\frac{s}{k} - d\right) = rk(sp_K - d)$ = capital contribution to total growth rate.

(23) $\cdot O = y_L \cdot L + r(s-dk) + \cdot A$

Profitable investment opportunities exist in the economy as long as the marginal productivity of capital r is greater than the gross cost of using capital.

This gross cost in money terms is the rate of interest i on long-term bonds for capital purposes, plus an annual sinking fund rate sf which, if accumulated over the life of a capital good at compound interest i, will amount to \$1.00, so that the asset can be replaced at the end of its life. Thus $r > (i + sf)$ (all in real terms). If $i = .05$ and life of asset = 15 years, $sf = .046$. If $i = .05$, and life of asset = 50 years, $sf = .0048$.

Formula (23) shows us that the capital contribution to growth in the more general formula is the same as its contribution in the simple case (22), where we ignored changes in population and technical progress, or treated them as zero.

Let us now consider what these formulas tell us about an economy which has fully absorbed its past technical progress and has reached a fully stationary state where $^{\bullet}L = {}^{\bullet}K = 0$. Now we have $sp_K - d = {}^{\bullet}K = 0$, so

(24) $s = d/p_K = d\,\frac{K}{O} = \frac{D}{O} = D^{\bullet}.$

Thus savings in this situation cannot be a matter of voluntary choice, if full employment is to be maintained. The savings ratio must be constrained to equal the proportion of GDP needed to replace capital consumption on the fixed capital stock.

Next we consider the moving stationary state, where $^{\bullet}O = {}^{\bullet}L = {}^{\bullet}K$, and $r = i + sf$. Now we must have

(25) $sp_K - d = {}^{\bullet}L$, and hence

(26) $s = \frac{({}^{\bullet}L + d)}{p_K} = k\,({}^{\bullet}L + d) = k{}^{\bullet}L + D^{\bullet}$

Again we have the savings ratio "locked in" by technical factors, and now also influenced by the population (labour) growth rate. It is still present, though latent and it has become pre-ordained in size if full employment equilibrium is to be maintained.

Now we are able to pose a fundamental question in our analysis. Suppose we are in an economy where there is still sufficient development to present unlimited investment opportunities. Then formula (23) tells us that the growth rate will be higher, the higher are r and s. If we assume that r, d and k are temporarily fixed by the technology, then the growth rate of output depends very much on the savings ratio, as well as on factor shares, and the growth rates of labour and technical progress. Is there any socially optimal value for s under these conditions?

Before approaching this vital problem, let us consider one further kind of equilibrium growth – the "golden-age" growth path, a concept first used by Joan Robinson [68, 69, 70]. On this path, output has reached a steady growth rate, assumed given by natural conditions, and the capital output ratio remains constant. What are the implications of a "golden-age" growth path to the savings ratio?

(27) $\cdot O = y_L \cdot L + (1 - y_L) \cdot O + \cdot A$

(28) $\cdot O = \cdot L + \cdot A/y_L = \cdot K = sp_K - d$ = labour growth rate, plus technical progress growth rate divided by labour's share.

(29) $s = k(\cdot O + d) = k\,(\cdot L + \cdot A/y_L + d)$.

Again s appears to be locked in or predetermined by the physical conditions of this hypothetical economy. Certainly $\cdot O$ and d are in this case given. If there is to be any variation in s it must be done through k. But variation in the capital/output ratio would depend on *easy* substitutability between labour and capital, which may be possible in the underdeveloped economy, but not so feasible in the mature economy. And we note that in any event, in the above circumstances, variation in s does not affect the rate of growth, unless it could affect y_L.

The golden-age growth path (28) is used as the basis for Projection No. 2 below. With k of the order of 3, and d of the order of .045, this would imply in this projection a fixed savings ratio of approximate value .27. For the growth rate $\cdot O$ is of the order of .045. In Canada the saving ratio is usually below this level although it has come near it in full employment periods.

To sum up, it appears that the rate of saving-investing in an economy can only exert a completely free influence on its rate of growth when there is an abundance of technical possibilities for profitable investment, created by development and innovations. Under such conditions the economy is in *growth disequilibrium*, and has much room for manoeuvre within the framework of (23), before it finally settles on some terminal growth path or turnpike which is stationary, moving stationary, or golden-age.

In arguing that the rate of savings does count in these situations where profitable investment opportunities abound, we assume that the savings will flow to those sectors of the economy where the marginal efficiency of investment is highest, that the productivity of the savings will in fact be maximized. Otherwise, changes in the saving ratio could produce opposite results to those suggested here.

Concept of An Optimum Savings Ratio

Economists have been searching for the "philosophers' stone" of an optimum savings ratio for a long time. Malthus, as quoted in Oskar Lange [53], observed the importance of saving to increasing wealth, and then pointed out that an excess of this virtue would destroy the motives to production. Lange [53] pushed on from this idea to study the full employment aspects of saving, and hence the "optimum propensity to consume". Lange's results were not operational, but could be made so by experimenting with parameter values in an appropriate econometric model.

In 1928 Frank Ramsey did a brilliant pioneering analysis [66] of savings, but he was attacking a rather different problem. He in effect assumed full

employment, and the existence of unlimited investment opportunities, until a state of "Bliss" is reached. Bliss was a state of maximum utility from consumption per capita. His problem was to find the best path of saving and growth to reach Bliss as soon as possible, subject to satisfying current needs for consumption. His analysis seems to imply a high rate of saving in a poor society, with the rate of saving diminishing as Bliss is approached. But again his results are not operational.

In fact it is only recently that what may be called an operational solution to this problem has been put forward. This solution only represents a start however on what is a rather big problem, for it is based on certain restrictive and simplifying assumptions. According to Joan Robinson [5] the new theorem was first enunciated by Professor Trevor Swan in 1960. The first published proof appears to occur in a humorous fable by Phelps [62]. Further proofs have since appeared in Champernowne [5], and in Kurz [52].

The *theorem* may be stated as follows: If an economy is heading to a terminal natural golden-age growth path, with natural rate of growth determined by constant rates of growth of population and technical progress, then per capita consumption will be highest on this terminal path if the rate of saving is equal to the share of profit in income. A proof of this theorem, following Phelps, is given in Note 2 to the Appendix to this chapter.

Corollary 1

On the terminal growth path the natural growth rate g plus rate of depreciation d equals the terminal marginal productivity of capital r, equals the interest rate, plus average sinking fund rate necessary to replace capital at the end of its life. For savings sO = gross investment $gK + dK$ = gross return to capital rK. Hence $g + d = r = i + sf = \dot{L} + \frac{\dot{A}}{y_L} + d$. If $d = sf$, then interest rate $i = r - d = g$.

Corollary 2

On the turnpike all of the investments which create vertical growth have been used up, and we are left with only the growth in labour and technical progress. Since this terminal path has valuable properties, the *sooner* the society reaches it the greater may be its economic welfare. To speed up this transition would mean making use of all investment opportunities for vertical growth as quickly as possible. Thus during the disequilibrium period when $r > i + sf$ the appropriate policy may be for government to increase s, to make more vertical investment possible. At the same time k is likely to increase as the economy increases its use of capital goods in production. Once the transition period is over and k has been lifted to conform to all available investments in vertical growth, s must be reduced to

(30) $s = (g + d)\,k$. It must now conform with the equilibrium conditions on the turnpike, as depicted above.

Kurz has gone one step farther and proved a theorem [52] that an economy with saving ratio equal to the capital share of income will have the highest rate

of growth of per capita consumption while approaching some terminal path. This theorem (see also Note 2,Appendix) seems to be more relevant to our general case of disequilibrium growth with abundant investment opportunities.

Phelps [62] now develops the theme that if a society follows the rule that $s = y_K$, then each generation is having the best possible consumption path per capita. He calls this the *Golden Rule Path.* To get on this path it is necessary to do two things. The society must first bring its capital output ratio up to the value indicated in (30). Then it must continuously re-invest all of the earnings of capital in capital. The first operation appears to be necessary for the continuous maintenance of full employment, so that $sO = (g + d)K$ for all time periods.

It may be of interest at this point to enquire how close Canada may be to a Golden Rule Path. When Canada is at high level employment our gross saving ratio is of the order of .20 (Chapter 6), while the gross share of capital in income is declining toward .40. Our golden-age growth rate is of the order of .045 (Chapter 8) and our capital/output ratio k is now about 3.0. Also d = .045. On the basis of (30), if we wanted to get on a Golden Rule Turnpike, we would have to adjust our k to 4.4, and start saving at rate s = .40 instead of .20. Our terminal growth rate would still be .045, unless the larger k affected y_L in (28).

But while we were approaching the golden-age turnpike, assuming adequate investment opportunities, our growth rate from (23) would be $\dot{O} = .065$. (Here we use data of Chapters 6–8.) According to the theory above we would enjoy maximum standard of living on this approach as well as on the terminal turnpike. Clearly however it would require a considerable alteration in the Canadian economy to put it on its Golden Rule growth path. We would have to double our gross savings ratio s and increase our capital/output ratio k by a third.

Note that these rules for maximizing the path of consumption per capita can only be applied to non-human capital. If all the profits of human capital (education, training and skills) were re-invested, consumption would be held at the level of the wages of unskilled labour plus perhaps the rents on special natural skills.

Applications of Our Theory for a Practical Approach to an Optimal Growth Path

The above theory including the Golden Rule growth path provides us with seemingly useful sign posts for practical policy. However for steering an actual economy along an optimum achievable growth path we must start from where we are, and we must also consider any restraints provided by the particular real economy being steered. In particular few modern societies, developing or mature, appear to get on to smooth turnpike or golden-age growth paths at full employments. They are all subject to many disturbances arising from the business cycle, exogenous forces and basic structural problems. Also even the mature economies make continuous technical progress, including both major and minor innovations. These permit "disequilibrium" growth while they are fresh, at

faster than turnpike or golden-age steady growth rates. Under these conditions the general equations (15) – (18) and (23) are operative, and also capital/output ratios may change.

Let us now assume that a society, for whatever reasons, for example welfare and defence, wants to achieve an optimal growth path. It wants its economists to advise it on how to achieve such a path. What advice can the economist give at this juncture?

First we must decide on the basis of general and technical discussion what is meant by an optimal growth path. In a democratic society general social preferences (the social welfare function) must be given full play in arriving at this definition and any qualifications. Let us assume that the society decides that maximum national consumption per capita for its generation plus an even better standard of living for the subsequent generation is its choice. In short it wants the best it can have for itself, without impairing continued growth in standard of living for future generations. This will be a kind of "golden rule" growth path.

If the society could move immediately on to a Golden Rule approach, the problem would apparently be solved. But savings ratios and capital/output ratios could not be altered, to the extent required for this in the Canadian economy, in other than a gradual process. Hence we must discuss some kind of gradual approach to a maximum standard of living growth path.

In this approach, we might not be able to take a constant growth rate path all at once, and then we would have to tackle the problem of the optimal time pattern of consumption through the generation. Suppose we consider a generation to be thirty years. Total consumption per capita over the thirty years can be represented by the area under the time graph of consumption per capita for this period. A time profile of no change for twenty-five years followed by a massive increase for the last five years might produce a larger area than one with a more steady growth over the whole thirty years. Yet the society might prefer the path with the smaller overall area, but without the long period of no improvement at all in their standard of living.

Let us assume that the society decides that it prefers a standard of living growth path which has the *maximum possible area over thirty years*, which would not cause any decline in the standard of living of the next generation below the peak level reached by this generation, and where the standard of living never declines, and never stays stationary or constant for more than two years at a time. Such constancy might be tolerated because of the availability of unusually productive investment opportunities which would require heavier current savings but very high pay-offs after two years.

Note that, in this concept of the standard of living profile, we are not discounting the future. We are assuming that for a whole society each year is as important as any other year, that decreases in standard of living involve large increases in the social marginal utility of consumption, while large increases in standard of living in the short-run cause diminishing social marginal utility of consumption.

Having settled on the kind of optimal growth path which the society wants, the economists can then go to work to advise the society through its government on policy to achieve this growth path. In pursuing such policy the government must make a combined attack on growth, high level employment and structural problems, for all three are related. By high level employment we shall mean the use of the labour force up to the point where frictional strains begin to appear, and just short of wage inflation or final demand inflation. To be more specific, we shall think of high level employment for Canada as somewhere from 96 per cent to 98 per cent of the labour force. Canada has seasonal and structural problems as well as difficulties of distance and remote areas which affect the mobility of labour, all which are such that the above dimensions seem appropriate for the present, until more research is put on these problems. High level employment is fundamental for humanitarian and social welfare reasons. But in addition we cannot achieve our optimal growth path as defined above, if we have unemployed labour and capacity. This point is elaborated in Chapters 4 and 5.

To achieve all three goals, the government will need a good econometric model of the economy, a model which portrays both its short-run behaviour (cf. Section B of Bibliography) and its long-run or growth behaviour (cf. Chapters 9 and 10 below). Employment and structural problems are discussed in more detail in Chapter 4, and the complete econometric model will help to solve both of these problems, but especially the employment problems, within the growth context.

Having examined its employment and structural problems the government must next study the growth potential through saving and investing. Here the main aim is vertical growth as defined above. The question then is: Does the economy contain investment opportunities with high marginal productivities r, as a result of past development and socio-technical progress; because of expanding markets; or because labour and capital are coming into ever better proportionality with the natural environment? Such opportunities will be indicated by micro and industry studies, and by the level of r indicated by the econometric model. For Canada, the model in Chapter 9 below indicates a real marginal productivity of capital of 15 to 20 per cent. If such high yields really exist, both government and society might feel that a higher savings ratio was worth while, something closer perhaps to the Golden Rule saving ratio. Such high yields do not usually filter down to the general investing public, partly because of corporate savings, (although these do add to yields through the medium of capital gains on common stock), and partly perhaps as a result of the "managerial revolution".

If we consider formula (23) above as the basic formula to keep before us, assuming that we are in a disequilibrium growth situation with abundant investment opportunities, then clearly a higher savings ratio would give us a higher growth path. But as we shall see in the next chapter, our highest potential saving ratio can only be achieved at high level employment.

Government is able to alter the national savings ratio through its economic policies and the advice and counsel it can give to business and the general public on growth potential, and through its own consumption and investment. For

government consumption is a part of national consumption and government investment in social capital is a part of national investment. Consequently, with the help of a good econometric model advisers to the government can test alternative feasible consumption-savings patterns at high employment, recording the time graph of real national consumption per capita for each pattern tested. These tests can be combined with tests of alternative monetary, exchange rate, taxation and commercial policies. Out of all of these tests an optimal time profile of the standard of living will emerge, indicating the lines of optimal policy.

In carrying out its policy research, government can also keep in mind that the growth in technical progress in formula (23) ($\dot{A}$) is an important component of economic growth. Such progress can be stimulated by increasing support and encouragement of education, health and basic research. Governments are of course well aware of these matters nowadays. Suffice it to mention that these are all areas where *external economies* are high, where gains spread well beyond the individuals or projects on which the initial investment is made. Consequently marginal social gain is much higher than marginal private gain from such investments. Private investment would accordingly not be as high in these areas as would be beneficial to society, and public investment in these fields is necessary to get optimal investment and resource use.

Conclusions

This chapter has tried to touch on the highlights of growth theory. The components and casual forces behind economic growth are summed up in formulas (4), (15) and (23). Most of these components are interrelated. Population growth, participation rates and hours of work depend on the level of real income reached, and the growth potential. The savings ratio depends upon the marginal productivity of capital, and investment opportunities. It can sometimes be freely chosen, and is sometimes locked in by the other conditions. It cannot be freely chosen when there is less than high level employment. In the modern economy education, health and basic research are vital to growth through the technical progress factor $\dot{A}$.

The concept of an optimal growth path is gradually being worked out. To reach such a path will require advanced research with econometric models, and appropriate government policies. Such policies can be mainly indirect monetary, fiscal and commercial operations which leave individual economic units free to make their own decision within the environment so provided. But they should be accompanied by general public education on the objectives and methods of policy, to enlist public support. They must attack simultaneously the problems of growth, high level employment and structural maladjustments.

In the next chapter we discuss some of these problems in a little more detail.

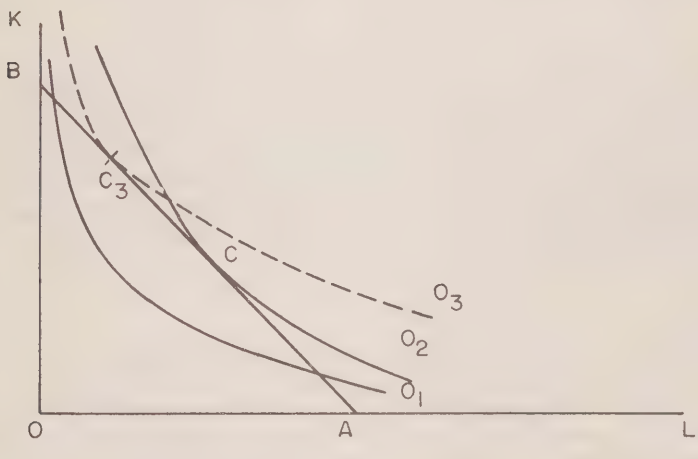
APPENDIX 3—1

Note 1

Let the isoquants in the following diagram represent contour lines on the production surface

(1) O = Af(L,K)

As A increases with technical progress, the output level represented by each contour line increases. The production function has lifted, or more correctly, rotated about the pivot O in the diagram.



The proportionate use of K and L in production will depend on their relative costs i + sf (yield on long-term bonds plus sinking fund rate which will replace one dollar's worth of capital with a dollar's worth of equivalent capital at end of life of current new capital), and w_h (average hourly earnings of labour). The price or market line AB represents possible market choices between labour and capital. C represents the equilibrium choice at maximum profit or minimum cost, and indicates the capital/labour = K/L ratio appropriate to the current price ratio $w_h/(i + sf)$ = slope OB/OA (absolute value).

One definition of *neutral technical progress* is that it increases the values of contours O_1 and O_2, but does not alter the K/L ratio, for a given price ratio OB/OA.

The contour line O_3 would then represent non-neutral technical change, with an increase in the K/L ratio at C_3.

The equation of a contour line of (1), for given A, is

(2) $dO = A\frac{\partial f}{\partial L}\,dL + A\frac{\partial f}{\partial K}\,dK = 0$

(3) $-\left(\frac{dK}{dL}\right)_p = A\frac{\partial f}{\partial L} \Big/ A\frac{\partial f}{\partial K} = \frac{\partial f}{\partial L} \Big/ \frac{\partial f}{\partial K} =$

slope of production contour line. If only A changes, this slope does not change and technical change is neutral. In the case of O_3, in general the slope of the contour line is reduced. Hence $A\frac{\partial f}{\partial K}$, the marginal productivity of capital, has increased relative to $A\frac{\partial f}{\partial L}$. The technical change represented by O_3 is capital-using, or labour-saving, and is non-neutral. For a given scale of use of factors, the O_3 change implies a change in the f part of (1).

Note 2

Assume that the economy is in a condition of growth disequilibrium so that there is abundant investment opportunity. Then we can follow Phelps [62] and assume that the height of the growth path will be an increasing function of s. (Apply (23) of this chapter.) Assume next that the economy is moving toward a golden-age growth path, on which it will have a constant growth rate g. Then if O_o is the level of output at which it enters this path, we have

(1) $O_o = f(s)$

(2) $O_t = f(s)e^{gt}$

(3) $C_t = (1-s)f(s)e^{gt}$ = quantity of consumption at time period t.

Assume that N and L grow at constant rate n. Then real consumption per capita, our surrogate for the standard of living, will be at its highest level on the golden-age growth path if C_t is at maximum level all along this path.

What value of s will maximize this C_t?

(4) $\frac{dC_t}{ds} = (1-s)f'(s)\,e^{gt} - f(s)e^{gt} = 0$ at maximum C_t. Hence

(5) $\frac{sf'(s)}{f(s)} = \frac{s}{1-s}$

Next note that

(6) $O_o = f(s) = F(L_o, K_o)$ Also, for full employment equilibrium growth

(7) $sO_o - D_o = gK_o$; $\frac{sf(s)}{g+d} = K_o$

(8) $f(s) = F\left(L_o, \frac{sf(s)}{g+d}\right)$

(9) $f'(s) = \frac{\partial F}{\partial L_o}\frac{dL_o}{ds} + \frac{\partial F}{\partial K_o}\frac{dK_o}{ds}$; $\frac{dL_o}{ds} = 0$

(10) $f'(s) = F_{K_o}\left[\frac{sf'(s) + f(s)}{g + d}\right]$

(11) $f'(s)\left(1 - \frac{r_o s}{g+d}\right) = \frac{r_o f(s)}{g+d}; \frac{s}{g+d} = \frac{K_o}{O_o}$

(12) $\frac{sf'(s)}{f(s)} = y_K \Big/ (1-y_K) = \frac{s}{1-s}$ from (5)

Therefore, for maximum C_t and C_t/N_t

(13) $s = y_K$ = the share of output going to capital goods.

This theorem can be arrived at more easily but with less generality, if we follow a suggestion made by Joan Robinson [5]. Assume that all income paid to labour is consumed, and that savings are made only from property income. Let the property income savings ratio be s_c.

(14) $s_c rK = sO; s = s_c rk$

(15) $\dot{K} = \frac{s_c rK - dK}{K} = s_c r - d$

Under our assumptions, capital will have its fastest growth rate when $s_c = 1$. For a given growth rate of population and labour, both vertical growth and $\dot{O}$ will be maximized (see (17) above) when $\dot{K}$ is at a maximum, assuming y_K to be fairly stable. With a fixed s and n, the rate of growth of C/N will be maximized when $\dot{O}$ is maximized. This will all occur when $s_c = 1$, and hence $s = rk = y_K$.

When this happens, we also have $\dot{K} = r - d$ = net rate of profit or net marginal productivity of capital. On the Golden Rule turnpike, $\dot{O} = \dot{K} = r - d$ (= $\dot{L}$, assuming temporary cessation of technical progress).

Note that this second proof is based on a restrictive assumption, and hence is not as general as the first one.

CHAPTER 4

DIVERGENCES FROM AN OPTIMAL GROWTH PATH WITH CYCLICAL AND STRUCTURAL UNEMPLOYMENT

Optimal Growth Paths

There is no single growth path which the economist can set out for society as absolutely optimal. Both economics and society are too complex for that. What he can do at this stage of growth theory however, is devise a small assortment of growth paths which seem to have optimal properties. These can then become candidates for social choice and economic policy. In this chapter we shall set out three such growth paths, and then consider what the problems are which may prevent an economy from staying on any particular one of these paths it may have selected.

The most formalistic of the three paths is the *Golden Rule Growth Path* which was discussed in the preceding chapter. If this were the path selected, the society would have to adjust its saving ratio s to equal the share of output flowing to capital goods (y_K). For this to be possible there must of course be abundant investment opportunities available as a result of past development and socio-technical progress. For this is a high saving ratio indeed. But its worth is that it promises this and all future generations the combination of steady growth and a maximum standard of living. Ultimately, and subject to further development, the economy will tend to move toward a constant capital/output ratio k. It will then switch on to a turnpike growth path where capital and output will both grow at the net rate of profit or net marginal productivity of capital,

(1) $r-d = {}^{\cdot}L + {}^{\cdot}A/y_L = g$ = golden-age and Golden Rule growth rate.

And on this equilibrium path the rate of profit r–d and the interest rate i will come into equality. During the disequilibrium period prior to the terminal equilibrium path, $r-d > i$. While this period lasts k must be adjusted so that the constant saving ratio can be maintained on the turnpike, taking into account the terminal r. For

(2) $s = y_K = rk$. Should technical progress $\dot{}A$ have become zero by the time the turnpike is reached, we have the rates of growth of output, labour and capital all equal, and equal to the net rate of profit on capital. $\dot{}O = \dot{}K = r-d = \dot{}L = \dot{}N = n$ (if labour input and population grow at the same rates) $= i$. Now we have, from the formulas of the previous chapter
(3) $s = (n+d)k$.

In either of these cases, k must be adjusted to the value of s before the turnpike, and to turnpike conditions. But our theory also suggests that, as an alternative to this, we might let k find its own value on the basis of prices of factors and the technology, and then continually adjust s to equal (g+d)k, as we approach the turnpike.

This growth path will present a smooth compound or exponential time profile up to the turnpike, and on the turnpike. But the turnpike rate of growth will likely be lower than that on the approach, since the marginal productivity of capital r will be gradually falling to equality with i. The Golden Rule path has of course the ultimate property which set the philosophers searching for it, namely that on the approach real consumption per capita or standard of living climbs at its fastest rate, and then standard of living along the turnpike is at its highest possible level, for all subsequent time periods and generations. It gets its name because it passes on to the next generation the highest possible exponential standard of living time path or profile, while at the same time the present generation is enjoying the optimal path available to it.

One defect of the Golden Rule path is its rigidity. For example, *if the investment opportunities are available*, a society might prefer to save even more of its income than that derived from physical (non-human) capital for a short period. This might put it on a much higher future turnpike, so that the area under the standard of living curve for that generation would be even higher than in the case of the Golden Rule path. The society might lose ground for two or three years but make up for this substantially in future times.

The second of the three paths which we consider was also discussed in Chapter 3. It involves a less ambitious but more carefully worked out approach to a socially selected time path of standard of living, with the aid of a detailed econometric model. In this approach the society is fully acquainted with the current advantages of increasing or decreasing the saving ratio for each year in sequence. An optimal time profile over a generation span of thirty years is selected from the alternatives which appear to be available. This path may be called a *generation optimized growth path*. It would not likely start off with such a high savings ratio as the Golden Rule path, and indeed might never reach such a high degree of saving. By definition (Chapter 3) it would not however impair the standard of living of future generations, and in practice this could be guarded against by producing a revised 30-year path every two or three years.

The third kind of optimal path which we shall consider may be called a *free high employment growth path*. On this path the society freely chooses, through the market mechanism, its participation rates, hours of work, and savings ratio. Its growth rate is then determined by the general formulas

(4) $\cdot O = y_L \cdot L + y_K \cdot K + \cdot A$

(5) $\cdot O = y_L \left(\cdot N + \cdot pr_1 + \cdot er + \cdot h \right) + r\,(s-dk) + \cdot A$

The choices are made on the basis of the current standard of living, and the current net marginal productivity or yield on capital. But in order for these choices to be truly free, a certain economic environment must prevail.

First and foremost, the economy must be maintained at high level employment. This is of the highest priority on humanitarian and ethical grounds. It is also vital for growth. In Chapter 3 we suggested that for Canada high level employment means an unemployment ratio to the civilian labour force of four per cent or less. An unemployed worker of course has little or no choice on his saving ratio. It will almost always be zero on the transfer payments he receives from government, and may even become negative if he uses up past savings. Yet he may have *planned* to save five or ten per cent of his income before stricken by unemployment.

But a major portion of national saving comes from business firms [39 p. 42] and substantial savings may also sometimes be made by government. The saving of business firms must necessarily also be affected as sales fall off, and production declines well below capacity during depression. Savings are what is left out of profits after dividends are paid. Profits fall drastically during depression, because of heavy fixed costs, and because of reduced average productivity of factors of production. These are presumably at their best relative proportions to each other at full-capacity operations. Dividends may be kept at a fairly stable level as long as possible.

In the case of government there are also many fixed costs which cannot be reduced in depression, while during such a period transfer payments for welfare increase, and tax revenues fall off. Most governments nowadays incur negative savings or deficits during depressions.

To sum up, we can only discover the free saving choice of workers, business and government combined, when the economy is operating at a high level of employment. We find in Chapter 6 and Appendix A that the gross national saving ratio out of GNE (S^{no}) was 25 per cent in 1926 and 22 per cent in 1952, periods of high employment, but only five per cent in 1933.[1]

It is clear from the production function $O = Af\,(L,K)$ that the level of the growth path will be at its current maximum when employment is at its highest possible level. But we also observe from (4) and (5) that the *growth rate* will be maximal under high level employment, mainly, because of the effect of this on s and $\cdot A$. Also with s applied to a lower GDP, $\cdot K$ will slow down considerably. The effects of unemployment on $\cdot er$ and $\cdot h$ will exert marked temporary effects on $\cdot O$, as well. With the marginal productivity of capital becoming zero in all industries with redundant capacity, r will tend to fall.

We can conclude then that the free growth path will be higher in both level and growth rate than a path which is periodically disturbed by cyclical unemployment or stagnation. It is still possible however to have fairly vigorous

[1] Basic Historical Data (BHD), Appendix A, Section C, Table 2; the saving-investment ratio s includes capital imports, and is total investment to GDP; Section E, Table 1.

growth along with fairly severe structural unemployment of the kind produced by excessive population relative to resources or markets (cf. Italy, or the Canadian Maritimes) or where there is technological unemployment. These cases are discussed later in this chapter.

A second requirement other than high employment for the free path is that the income distribution be both welfare promoting, and growth stimulating. This is not the place to go into any analysis in this controversial area. But we are interested in economic welfare and in growth, and neither of these is likely to be maximized if the income distribution is at the extremes of complete equality, or of great inequality. In the first extreme we would not likely get motivation and efficiency, and neither would we in the latter extreme. Nor would we likely have political stability in either case [103]. But at some distribution in between these extremes we can presumably reach optimum welfare and growth in terms of truly free market choices; maximum standard of living, mass markets and large-scale production; willingness to invest in education, training, and skills, and in physical capital; willingness to give one's best as entrepreneur, manager, professional person or workman.

A third requirement for the free path, if the society is to make its best choice with respect to saving, is that the society be aware of and have more direct access to the true marginal productivity of capital [104]. That this is not the case is presumably due to imperfections in the capital market, and perhaps also to the so-called ''managerial revolution''. The net return on capital to the general public is roughly three per cent to six per cent, whereas our econometric analysis below suggests that the gross return is from 15 per cent to 25 per cent with net returns from say 12 per cent to 20 per cent. The general public's willingness to save might be quite different if it could count on yields of this order of magnitude.

If a society has in effect or implicitly elected the free, high employment path of growth, then the *potential* level of this path at any time, and under the conditions assumed, will be given by its production function.

(6) $O = Af\,(N.pr_1.er.h,K)$. It will thus depend on the total productivity of its labour input and capital input, on the size of its labour input and its stock of capital, and on the stage of technical progress it has attained. Then its potential growth rate from this level (or the slope of its potential time profile on a semi-logarithmic graph) will be given by the general formulas (4) and (5). Both level and slope of the growth path could be increased from the *free potential* to a *ceiling potential* under emergency conditions, by increasing $pr._1$, er, h and s to levels which would maximize O and $\cdot O$ on a sustainable basis.

We have now considered three kinds of optimal growth path which a society might select as an economic and social goal. Let us refer to these for brevity as the Golden, generation and free paths, or sometimes simply as paths 1, 2 and 3. In this chapter our prupose is to consider what economic problems may make it difficult to stay on the path selected, and consequently prepare us for considering the kinds of policy which a free society might choose to maintain its course on the growth path selected. We begin with a brief review of the historical pattern of growth, and of the forces which determine the level of employment.

Historical Growth Behaviour in the Mature Economy

Here we shall only attempt, with a few fast sweeps of the brush, to give a broad picture of the pattern of growth in the mature economy. We shall use Canada as our main example, since our statistical analysis in the subsequent chapters relates to Canada. But the picture presented is of general applicability, and would not be substantially different for any of the mature economies. According to Rostow's historical analysis [72] Canada became a mature economy, thereby applying advanced methods of science and engineering in secondary industry, around 1950. But she had entered the stage of high mass consumption shortly after 1920, presumably drawn along by the United States. The usual sequence is for maturity to commence well in advance of high mass consumption.

The growth pattern in Canada is described in more detail in Chapter 6. In summary it has been one of exponential or compound growth of output and of labour input. The compound annual rate of growth of output from 1926–1961 has been three and one-half per cent. But the exponential path was severely interrupted by the major depression of 1929–1939, with less severe interruptions resulting from minor recessions as in 1949, 1954, 1958, and 1960–61. From 1957 to 1961, Canada experienced a slower rate of economic growth, with some improvement in the rate taking place in 1962 and 1963.

The ratio of unemployment to the civilian labour force leaped from two and one-half and three per cent in the late 1920's to 20 per cent or more in 1933. In the post-war period it began a slow and steady climb from below two per cent to four and one-half per cent in 1957. But with the recession of 1958 it seems to have shifted upward to a higher trend at level six and one-half per cent to seven per cent. With the upswing of 1962 it had declined to six per cent and still further to about five per cent in 1963.

The capital/labour ratio after falling during depression and war has been climbing steadily since 1946, indicating some combination of labour-saving technical change, and the substitution effects of increasing wage rates relative to capital costs.

The capital/output ratio $k = 1/p_K$ has a long-term downward trend 1926–1961. But this contains two distinct phases. The first is 1926–1944, when k was falling sharphy. The second is 1944–1961, when k has a weaker, but distinct upward trend.

If now we apply high level employment conditions to our formula (5) above, using the 1926–1961 growth rate of L of 3/4 per cent, and a marginal productivity of capital r as estimated for this period at an average of 15 per cent (Chapters 6 and 9), we can estimate a free potential growth rate for 1926–1961. It comes out to be[1] of the order of four per cent, and assumes a slightly higher investment-savings ratio (1956) than Canadians have been willing to make on their own. What is being assumed however is that with better knowledge and availability of investment yields, and continued full employment they might have been willing to invest at this level, using more of their own savings and less capital inflow.

---

[1] $\dot{0} = .53 \times .0075 + .15\,(.29 - .045 \times 3.5) + .017 = .041$. Here I have used civilian gross domestic product, GDP_c, and the ratio of national investment to GDP_c for 1956 to represent s.

The growth path which Canadians might have had under these conditions could be estimated using the econometric model of Chapters 9 and 10.

It would be almost everywhere higher than the observed historical growth path, because there would be no deep valleys in the profile arising from depression, recession or stagnation, and because, after 1929, the stock of capital would always have been higher than the historical series. At the same time the existing stock would have been fully used. Economic welfare and the standard of living would have been almost everywhere higher than on the observed historical growth path.

Forces Affecting Employment Levels

It appears from our analysis above that the greatest immediate gains for Canadian economic welfare can be had by achieving and stabilizing high employment output. This will increase the level of the growth path considerably, but the growth rate only slightly. It will accordingly make the Canadian economy much stronger, from the point of view of pursuing its economic and social goals. But mainly it will have removed the social and economic consequences of unemployment. As this stage is reached, a firm foundation has been laid for efforts designed to achieve higher rates of economic growth.

What are the obstacles to high employment, the causes of unemployment, in the mature economy and within the dynamic context of growth? Let us for the moment assume away structural problems, such as an excess of population in relation to resources. Under these assumptions the broad explanation of unemployment in the short run is the Keynesian explanation [92]. Aggregate demand for goods and services is inadequate relative to aggregate supply capacity of the economy to bring an equilibrium between demand and supply at a high level of employment. *Effective demand,* the intersection between the aggregate demand function and the aggregate supply function, the ex post equilibrium values of demand and supply, is below the high employment *capacity supply* of the economy.

The free high employment growth path outlined above is then essentially a capacity supply path for the economy, based on social choices as they would be made at continued high level employment. But supply is of course only a potential, until called into being by demand. If this capacity supply is in fact being produced, and effective demand proves to be less, then this level of supply and employment cannot persist for more than a short period. For undesired inventories will pile up, and firms must fairly quickly reduce output and employment to the equilibrium level.

Hence it follows that in the short run it is the level of the aggregate demand for final goods [1] that determines the level of employment and output. It is important then that we take a brief look at the sources or components of this aggregate demand.

First we have total personal demand for consumer goods. The demand of an individual for specific consumer goods is essentially his willingness to part with

[1] We use the term "goods" in a broad economic sense to include commodities and services.

his money for them. This depends upon the intensity of his desire, the prices of the goods in comparison with the prices of other goods, and the extent of his money and resources. This latter depends upon his income and wealth and credit standing. The existence and level of an individual's demand is revealed by his actual expenditures on consumer goods.

An individual pays for consumer goods out of his income and wealth, and saves some portion of his income as a basis for future consumption. Saving by individuals is essentially a purchase of command over goods at some future time. Another kind of final goods demanded in our economic system is investment goods – inventories, machinery, equipment, plant and construction. These are mainly demanded by business firms. They accumulate into stocks. The fixed capital goods have the special property of giving service over a long life, so that replacement is deferred in most cases for a long time.

Business firms also save, when they accumulate depreciation reserves, and when they do not distribute all of their profits. Their usual motive for saving is to have the finance available for investing in replacement and in further expansion of productive capacity.

Government at three levels in Canada is also a demander of goods. Through providing collective services like social co-ordination and education, government provides collective consumption for a society. At the same time government requires vast amounts of capital goods for performing its functions. It is consequently also a maker of social investment and a provider of social capital.

It follows that the aggregate demand for final goods by a whole society can be divided into two broad classes – demands for consumption goods, and demands for investment goods. (For the purposes of the present analysis we can assume no foreign trade.) We shall call these *national consumption* and *national investment*.

The aggregate demand for national consumption will be a function of population, habits and customs, income and wealth. It is a fairly stable function, and hence savings out of the relevant income will also be a rather stable function. The aggregate demand for national investment comes from business firms and government. It depends on the extent of recent economic development, and on socio-technical progress, which may require capital deepening; [1] it also depends on the state of economic growth, which will sooner or later require capital widening. Capital growth is consequently both a cause and an effect of economic development and growth.

When we analyze the nature of the demand for investment goods, especially in the mature economy, we deduce that it is not likely to be a stable function of population, income and so on. It is more likely to be unstable, volatile and difficult to predict. Let us take a brief look at why this is so.

---

[1] Capital deepening is sometimes defined to mean an increase in the capital/output ratio. However, in conformity with our definitions of vertical and horizontal growth in Chapter 3, it seems more appropriate to define capital deepening as an increase in K/L. For it is this ratio which appears in the formula for the vertical growth rate. Capital widening can then be defined as growth in K at the same rate as the growth in L.

The underdeveloped economy has a steady stream of development investment ahead of it as it builds up its technology. The mature economy on the other hand must await new innovations that require large amounts of capital goods to get a big stimulus to capital investment. More steady requirements for investment may come from socio-technical progress and from the capital widening of horizontal growth. But these will tend to be of smaller dimensions. One of the last really big innovations requiring great amounts of capital was the mass production of the automobile begun by Henry Ford. Such big innovations are spasmodic.

A further cause of investment instability arises from the *acceleration principle*. To the extent that technical progress and capital widening leave the capital/output ratio k constant, we have the following situation.

(7) $K/O = k \; ; \; \Delta K = k \, \Delta O.$

(8) $\Delta K = GI - D = k \, \Delta O.$

(9) $GI = D + k \, \Delta O.$

Here we have the demand for new investment goods represented as a function of the *change* of total output. If the change in output, even though still positive, becomes less, the demand for investment goods is reduced. Thus even while the consumption goods industries are still expanding, the investment goods industries may start to experience reduced output.

It is because of this natural instability of investment, based on the two broad reasons above, that the whole demand side of the economy tends to fluctuate. The supply side of the economy, by contrast, tends to be potentially stable.

It is at the intersection (or simultaneous solution) of the aggregate demand and supply functions that the level of effective demand (and effective supply) or output is determined. And it is the level of output that, in the middle and long run (one year and over) determines the level of employment. (Cf. the model of the economy in Chapter 9.)

An alternative way of looking at the mechanics of the level of employment is through the analysis of the savings and investment which parallel the above demand and supply picture. Gross saving is broadly equal to the amount of household and individual income not consumed, plus the profits of corporations not distributed as dividends, plus the depreciation allowances of firms, plus surpluses of government. [1] The saving of the personal sector tends to be a comparatively stable function for the same reasons that personal consumption is a stable function of its causal variables. The other components of saving tend to be more volatile. In the case of corporate saving, profits display high variability over the cycle, while dividend payments are kept stable for as long as possible [75 A].

Let us now assume that the economy is at high level employment or at full capacity output. Consumer and investment demand create aggregate demand, which equates with aggregate supply at full capacity.

---

[1] Note that in our concepts investment spending by government would not be treated as current spending, and on this basis the government surplus would be higher than is depicted in the national accounts.

(10) $C^d + GI^d = O^d = O^s = O_f$. In equilibrium terms,

(11) $C + GI = O$; $O - C = S$; $S = GI$.

Without going any further into the mechanics of income formation here, we can state the following results, which are derived from analysis in greater depth. In terms of equilibrium solutions, and in real terms, effective demand equals effective supply and produces the observed value of output. As demand and supply are equated saving and investment are equated (cf. equation (11)). But it is quite possible for *planned* saving and *planned* investment to be different.

If, for example, at full capacity output, planned investment is greater than planned saving, some investment must be foregone, and planned investment is reduced until actual or observed investment and saving come into equality. This is the situation to be found in a newly developing economy where, because of low incomes, planned savings are low, while investment needs are high. It is also the situation in an investment boom in the mature economy.[1]

But now assume that while savers are planning to save at full capacity income levels, investors find that their need for further investment has been reduced. The aggregate demand function moves backward or to the left, and an equilibrium value of output, income and employment is formed well below full capacity and high employment. Many who had planned to save find themselves without adequate incomes to save. Savings are forced down, and are brought into equality with the gross investment which business firms and governments have decided to make.

We can now draw an important conclusion. Under high employment conditions it is the level of saving which tends to determine the level of investment that is possible. (This is the case assumed in classical theory.) But under unemployment, with operations below full capacity, it is the level of investment needed and demanded which determines the amount of saving which a society can make. (This is the case analyzed in Keynesian theory.)

Cyclical Unemployment and the Failure of Demand

The causes of unemployment can be placed into two broad classes – cyclical and structural. Here we shall use our analysis of the mechanics of employment to sum up very briefly the general cause of cyclical unemployment. First our analysis tells us that once supply capacity and conditions are given, the level of output and employment are determined by the forces behind aggregate demand. Clearly then as long as aggregate demand is strong in relation to supply we shall have high level employment. If it is too strong we shall also have inflation. With weak demand we shall have unemployment. Under what conditions are we likely to have strong and weak aggregate demand?

---

[1] We are abstracting here from price effects which enable investors to bid resources away from consumers, thereby adding some "forced" saving (by inflation) to "planned" saving.

A poor country which has taken off into development is likely to have high and urgent consumption needs and wants out of its newly expanding income, and hence a low saving ratio. At the same time it has abundant investment opportunities. All it needs is savings, finance, and resources to fill in these opportunities. It is most likely to have strong aggregate demand, and one of its chief problems will be inflation.

By contrast let us consider again the mature and wealthy economy. Its consumption needs are not so urgent, and it can afford the luxury of more saving for its future security. Its saving ratio is consequently fairly substantial at high level employment. The large volume of savings which it generates at full capacity output must be matched by equally high real investment, or this level of output cannot be maintained. But the investment needs of the mature economy are not pressing, partly because of the generally long life of most fixed capital goods. Indeed as long as no major innovations are in process of creating development, the stock of capital may only need to keep pace with the growth in population. Some deepening may also be called for if there is some technical progress, and relative increases in wage rates. Under such conditions the mature and affluent economy is often in danger of having an insufficient demand for new investment to match its potentially heavy flow of saving. This is perhaps the basic cause of major cyclical instability in output and employment in the mature economy. It is part of the explanation of Canada's recent troubles.

But when some new innovation arrives in the mature economy, or when a cycle of durable goods replacement returns, the economy can surge forward with confidence once again. High level employment and high capacity operations return. If the innovation is capital using, like the steam engine, railways, electric power and the automobile, the demand for investment will be high. Other stimuli to investment are population growth, resource discovery, or situations like the filling in of backlog demands in the post-war period.

Recent innovations in the mature economies were referred to in Chapter 2 including television, electronics, automation, electronic computers, atomic energy and space research. So far and on the average these innovations seem to be labour-saving. It remains to be seen if they will eventually become sufficiently capital-using to bring about high-level employment, through substantial increases in the demand for capital goods.

However, about five years from now, commencing in the late 1960's, Canada can anticipate a population phenomenon which will generate considerable demand for durable consumer goods and housing. The post-war baby boom will by then have started to surge through the family formation age groups. The population aged 25 to 29 is predicted to increase by 33 per cent in the period 1966–1971, 29.5 per cent in 1971–1976, and 12 per cent in 1976–1981.[1]

Taking into account multiplier effects (in the Keynesian framework aggregate demand is equal to the multiplier $1/s$ times investment), and the accelerator effects

---

[1] See *Population Projections, Canada, 1961–1991,* by A. Stukel, in Appendix E at the end of this study.

discussed above, this situation is likely to generate a high level of employment in these periods ahead.[1]

While the major surges and recessions of demand and investment are associated with innovations and major exogenous forces, there are other factors that cause undulations or cycles in the economic system. These are firstly the presence of stocks, like inventories and fixed capital, which often act under the acceleration principle discussed above. In doing so they magnify any fluctuations that may have originated elsewhere in the system. At the same time the stocks tend to create cycles as they are built up toward desired levels, are often overbuilt as industries overshoot their needs, and as they are then reduced toward desired levels by a cessation or reduction of investment. In addition to this there are various lagged or delayed effects in an economic system, which are also likely to generate cycles.[2]

Cyclical Unemployment and the Growth Process

If the labour force is growing, and technical progress is taking place, there must be growth in output demanded and supplied, growth in effective demand and supply, if unemployment is to be prevented. And yet, paradoxically, the process of growth itself can create an obstacle to subsequent high level employment. It is Domar's special contribution, in his pioneering work in growth theory [18, 19], to have highlighted this point. Keynes however anticipates it in his Chapter 16 [92]. Let us analyze this point.

Let us assume a wealthy economy at high employment. Its gross saving ratio s will be high, generating a flow of saving sO. To maintain the high employment, gross investment for replacement, and for the expansion of the stock of capital must come forward in sufficient volume to absorb this high flow of saving. Thus to maintain a high employment equilibrium, we must have

(12) $sO = GI$. This will increase the stock of capital by

(13) $\Delta K = GI - D = sO - dK = (s - dk)\, O$.

This growth in K generates growth in potential output or capacity by $r\,(s - dk)\, O$, where r is the gross marginal productivity of capital.

It follows that the gross investment GI in the present time period has increased the high employment or full capacity output[3] of the subsequent time

[1] This improvement in the economic prospects for Canada does not minimize the necessity of tackling our current unemployment problems now.

[2] These effects are either domestically generated or international in origin and are then transmitted through variations in foreign trade and international capital flows from one country to another. We discuss the structural malajustments arising from foreign trade and capital flows later on in this chapter.

[3] These two concepts of high employment output and full capacity output are closely related in an economy where population and capital are in proper proportion or balance. We define full capacity output as that level at which average costs are at a minimum and factors of production are used most efficiently.

period by r(s - dk)O. Hence the flow of saving will increase correspondingly in the next time period, and so an *even greater quantity of investment* must come forward in this next period to maintain high employment.

But as the investment for a major innovation is gradually completed the marginal productivity of investment diminishes. The profitability of investment will fall. Combined with this is the *durability* of capital. The extra capacity created by investment may last a long time. It follows that the investment which creates high employment today may doubly aggravate the problem of finding sufficient investment opportunity for high employment tomorrow.

At some point in the aftermath of a big innovation the flow of saving will become greater than the quantity of new investment which businessmen think will be profitable. Unemployment appears and cyclical forces take over.

Here it would seem is the main explanation of the major divergences of the mature economy from its free growth path. The spasmodic occurence of major innovations requiring large quantities of labour and/or capital is one facet. The tendency of the growth process to use up its investment opportunities at an ever faster rate is another. It is for these reasons that high level employment is a *dynamic problem,* and that policies for high employment must be developed in a growth context. We consider the nature of such policies in the next chapter.

There are certain conditions in the economy under which we could get non-cyclical, equilibrium growth at constant growth rates. We now consider a few alternatives, as a conclusion to this brief presentation of some of the elements of a theory of growth.

Equilibrium Rate of Growth: Harrod

In his very seminal writings on growth and dynamics [33,34], Harrod has shown that there is a long run rate of growth, which is just sufficient, on the basis of the acceleration principle, to stimulate the necessary investment to sustain this rate. The acceleration principle assumes that K/O = k is constant for long-run growth at full capacity. Then as output grows, we have a demand for new capital as follows:

(14) $\Delta K = k \Delta O$; $GI - D = GI - dkO = k \Delta O$.

As this new capital is built it generates income and output through the multiplier process.

(15) $O = (1/s)\, GI$. Then growth in output is

(16) $\frac{\Delta O}{O} = \cdot O = \frac{GI - dkO}{k} \frac{s}{GI} = \frac{s}{k} - d = sp_K - d.$

Alternately, we can argue that output must grow at a rate which will induce new investment sufficient to continuously match the growth of current savings. Then $\Delta K = k \Delta O$; $GI = k \Delta O + D = sO$; $\frac{\Delta O}{O} = \frac{s}{k} - \frac{D}{kO} = sp_K - d$.

This is Harrod's ''warranted'' rate of growth. It will just sustain itself, with the right amount of investment coming forward in each time period, provided it is certain that income will continue to grow at this rate. It is thus an equilibrium rate of growth. But Harrod has argued that, this warranted growth forms a ''knife-edge'' growth path, with an unstable equilibrium. For should output for any reason fall a little bit below this path, it will move progressively farther below it under the influence of the accelerator and the multiplier. Conversely, should output get a little above the warranted path it will shoot progressively higher above it, under the same influences.

If we take another look at the warranted rate of output, we find that it is equal to the growth rate of the stock of capital. For if we divide (13) above by K, we get

(17) $\cdot K = sp_K - d$. Thus capital and output grow at the same rate, as of course it must if k, the capital/output ratio or accelerator is to be constant. The warranted growth path must consequently be a golden-age path (Chapter 3), where

(18) $\cdot O = \cdot L + \cdot A/y_L = s/k - d$.

With k fixed, and d, $\cdot L$ and $\cdot A$ determined mainly by technological and exogenous forces, the value of s which would produce equilibrium on the warranted path is severely restricted.

For example, if Canada had stayed on a warranted or golden-age path 1926–1961, its growth rate would have been approximately $.0075 + \frac{.017}{.500} = .042$. With $k \doteq 3$ and $d \doteq .045$, this would have required s to be 3 (.042 + .045) = .261. Canada could have stayed on this ''knife-edge'' path, with moderately high employment, if gross investment each year had been .261 of gross output. The historical rate has ranged all the way from 0.057 in 1933 to 0.289 in 1956. Only in two years out of 36 has the ratio been at or above the golden-age rate required.

Harrod also works with what he calls the ''natural'' rate of growth. This is determined by the growth of population, labour force, stock of capital and technical progress. It would correspond to our free high employment path, which is a growth potential under free conditions. The natural growth rate is given by (4) and (5) above. If savings habits and k are both fixed, then there is no need for the warranted and natural rates to be equal. This is why the warranted rate is likely to be unstable. Suppose for example that the natural rate for Canada 1926–1961 was .042, and that savings habits gave s a value of .2. Then with $k \doteq 3$, we have a warranted rate of $\frac{.2}{3} - .045 = .022$. Growth at the warranted rate would create unemployment, lack of confidence and investment would be cut below even the .2 rate. A cycle, of the kind we are so familiar with, would have begun.

Appropriateness of the Saving Ratio

Our analysis begins to suggest that, given the conditions of technology and the capital/output ratio, just any saving ratio which a society may select may not be in its best interests. Let us consider a few examples.

Case 1.

Let us assume a mature and wealthy economy with no innovation and no population growth. Capital stock will not grow, for this would reduce its net marginal productivity below the interest rate. We have a classical stationary state. The only need for investment is to replace depreciated capital. Then,

(19) $GI = dK = dkO$; $S = sO$. For an equilibrium of output, we must have the condition

(20) $s = dk$; $sp_K - d = 0$.

For a rich society at high employment we might have $s = .25$, $d = .045$, $k = 3$. Here we have the investment ratio $dk = .135$, and the saving ratio .25. This society will sink into unemployment. To prevent this, public policy would have to try to increase d and k or decrease s. To increase d through accelerated obsolescence would be wasteful. There might be some scope for increasing k, through increasing public investment in social capital. But the main adjustment would have to be made through reducing the national propensity to save.

Case 2.

Consider the same economy as for Case 1, but with population and labour input growing at $\dot{N} = n$. The stock of capital must grow at the same rate as labour input, to keep the labour force properly equipped. Gross investment is now $dkO + nK$. Equilibrium growth is possible in this situation if

(21) $sO = dkO + nkO$; $s = dk + nk$. From equation (4) we find $\dot{O} = n$, so that output, labour and capital are all growing at the same rate. The natural rate of growth is n, and since the warranted rate is always $sp_K - d$, we have from (21) that the warranted and natural rates are equal.

(22) $n = sp_K - d$. This should accordingly give a stable equilibrium growth path, developing neither unemployment nor inflation.

But let us again consider any limitation this may place on the saving ratio. Continuing the same data used for Case 1, and using the growth rate of Canadian labour input $\dot{L} = .008$ for 1926–1961, we have $s = (.045 + .008)3 = .159$. But as we have seen, the high employment saving ratio for Canada is of the order of .25. Hence, to maintain high employment equilibrium growth in this case, it would be necessary to reduce s from .25 to .16.

Alternately, the equilibrium conditions (21) and (22) could be maintained if the growth rate of man-hours of labour could be increased to $n = .25/3 - .045 = .038$. The higher saving ratio of .25 could now be maintained because of the capital investment needed for this rapidly growing rate of labour input. But the level of investment required in this situation involves a rate of growth in annual man-hours of 3.8 per cent. Most countries would find it difficult to maintain such a growth rate for long.

Case 3.

Let us now assume the same conditions and data as for Case 2, but with neutral innovations growing at rate $\cdot A = a = .017$. With neutral innovations capital and labour grow at the same rate. Hence

(23) $\cdot O = y_L \cdot L + y_K \cdot L + \cdot A = n + a$.

This is the natural rate of growth, and it is constant as long as n and a are constant. The warranted rate of growth still has the formula $sp_K - d$. But now it is impossible to equate the warranted and natural rates, for in this case output grows at a faster rate than capital. Also in this case k cannot be constant but falls at rate $-a$.

We can however find an equilibrium condition in this situation, with saving and investment equated in each time period. It is:

(24) $sO = dK + nK$; $s = (d + n)k$. To maintain this equilibrium it would be

necessary for s to fall at compound rate $-a$, as k fell. Given the average Canadian conditions 1926–1961 in this particular case, we would have $\cdot O = .008 + .017 = .025$. s could start off at value $(.045 + .008)3 = .159$; but it would have to fall at compound rate $-.017$, to preserve equilibrium.

Case 4.

In this last case we assume an economy on a golden-age path with capital and output growing at the same rate, so that $\cdot O = \cdot L + \cdot A/y_L$. This is the natural rate of growth of this economy, if L is always at full or high level employment. The warranted growth rate for this economy is, as always $sp_K - d$. For equilibrium growth at high employment warranted and natural rates must be equal, giving us the condition for this golden-age growth.

(25) $s = (d + \cdot L + \cdot A/y_L)k$. We can also find this condition by equating gross

saving and investing at each time period. Thus $sO = dK + \cdot O.K = dkO + (\cdot L + \cdot A/y_L) kO$. For Canada over the period 1926 to 1961, very roughly we have $\cdot O = .008 + .017/.54 = .040$. Then for high employment equilibrium and golden-age growth Canada would have had to maintain a constant saving-investment ratio $s = (.045 + .008 + .017/.54)3 = .254$. These values correspond fairly well to trend growth conditions (excluding the effect of cycle upswings) in the Canadian economy at high level employment.

Note that the left hand side of (25) is the saving ratio to output, while the right hand side is the investment ratio. We have assumed a constant value for k, but our formula becomes more general if we let k vary. The indications are that for the United States, the United Kingdom and Canada the long-term trend of k had been downward. (Cf. [39] pp. 44–46, and Chapter 6 in this study.) However, since 1944 the trend in k has been upward in both the United States and Canada. Formula (25) then tells us that on this score these countries would need to progressively increase their savings ratios to maintain high employment equilibrium. In both countries however the trend in y_L is upward (cf. Kravis [108] and Chapter 6 this study), and this will have a counterbalancing effect on the s needed for equilibrium growth at high employment.

We have shown with these examples that with a fixed capital/output ratio, labour share of output, growth in technical progress and labour input, and rate of depreciation, the saving ratio for equilibrium growth becomes pre-determined by these conditions. However, some of the factors in this equation are not completely rigid, and in fact have trends. Also in the short-run we may be quite prepared to vary the saving ratio and the rate of growth to obtain short-run high employment. With the help of a detailed econometric model we can in fact have flexibility in the savings ratio to meet the needs of short-run employment.

The heart of the matter here is that for short-run problems both the saving side and the investment side of the economy can be varied to meet current conditions. All that is really necessary to maintain stability is that planned saving and investment be brought into balance by appropriate variation of either one, or both. Government can exercise considerable control over both s and GI, and as long as it guides sO (planned) into equality with GI, high level employment can be maintained. In acting as balance wheel, government does not have to arrange that $GI = D + k\ \Delta O$.

What then is the value of our growth theory? It can help us to see how we should be aiming s and GI if our objective is maximum growth and an optimum standard of living over the long run.

One obstacle however to the kind of flexibility we need in s for short-run manoeuvering is the difficulty of shifting resources between the capital goods and the consumption goods industries. A society needs a measure of flexibility in this respect, where too much rigidity would present a structural problem to high employment. The better our long-range plans however, to foresee and prepare for periods of high and low investment opportunity, the less need there will be for sharp and sudden changes in s to meet short-run conditions.

But a reasonable degree of flexibility will always be necessary to maintain continuous high employment. Such flexibility may be seriously hindered by structural problems in the economy, and we now turn to a brief consideration of these.

Structural Problems in Relation to High Level Employment and Growth

The pattern of demand in a dynamic economy is continually changing. New products and new industries are born and grow rapidly, while older products and industries find their demands falling away. At the same time the needs of econmic policy may be such that at one period, if investment is temporarily declining, it would be appropriate for the society to increase consumption and save less. The converse may then be true when investment opportunities are abundant. All of these situations, whether long-run or short-run, require flexibility in the outputs of different products and industries, and hence flexibility in the movement of workers and other resources between products and industries.

When this movement is too slow or impeded we say that we have *structural problems*. The pattern of demand is out of correspondence with the pattern of

supply. Hence we have excess demand in some products and industries and excess supply in others. The excess supply creates unemployment. When this structural unemployment is large enough, it may in itself start to generate cyclical unemployment throughout the whole economy. Conversely, when there is a cyclical slowdown it is much more difficult to solve structural problems, and they become worse. Structural and the cyclical factors thus interact and mutually reinforce each other.

Just as we may have structural problems as between products and industries, we may also find them in factor markets. Some forms of capital may be too specific to be able to shift into a new line of output. In the same way workers may be trained in certain specific trades or skills, but find that the new industry or product requires new and perhaps more difficult skills. There may be an adequate over-all demand for labour, but a quite insufficient demand for some of the old skills. At the same time there will be excess demand for the new skills. Again we have structural unemployment.

Canada, in the aftermath of her post-war boom, suffers from a combination of cyclical and structural unemployment. These problems have been well described and documented in considerable detail [113–118] . Because of their major relevance as obstacles to high employment and growth, some of the main structural problems facing Canada are briefly mentioned here.

(a) Labour Force – Structural Unemployment

A certain proportion of our unemployment is of young people without enough, or the right kind, of education and training. Among the older people, some find that their skills are no longer in great demand, while there is excess demand for new skills. Governments have moved in the direction of providing more training facilities and financial assistance to help people to upgrade and alter their skills to meet the ever changing pattern of consumer, investment and foreign demand which presents itself to the economy [118].

In this regard an even fundamental problem may be starting to develop in our economies. It is related to automation, cybernetics, a second industrial revolution. To the extent that control machines replace men in controlling the power machines of production, automation may displace people in a way that no amount of training can correct. The demand for labour may shift in favour of higher *intelligence* and away from medium and lower intelligence, the latter having been replaced by control mechanisms. We might then have to contend with a basic structural unemployment in the lower half of the intelligence distribution in the labour force, with moral and social consequences that would be particularly difficult to deal with.

The upshot of this is that should such developments begin to look probable, we must set about designing a productive system that matches our people, rather than the other way around. This may not necessarily mean abandoning automation in any degree. It does mean that we must find useful and worthy things to be done by those displaced by automation. For human beings need to participate in production as well as consumption to have a sense of dignity and worth and belonging. We must never sacrifice humanity to machines.

(b) Declining Industries

It is inevitable that the changing technology and changing patterns of demand, combined with new resource discoveries will necessitate a decline in some industries. As examples in Canada we may mention agriculture and coal-mining. In the former, advancing productivity, combined with inelastic demand and foreign protectionism, requires a gradual exodus from the least efficient farms. This exodus does not occur with requisite speed and smoothness. With respect to coal mining, the great discoveries of oil and gas in Canada, coupled with a changing technology favouring petroleum, gas and latterly atomic energy, have dealt a serious blow to the coal mining industry. It has been difficult for labour and capital to leave this industry, with resulting unemployment of men and capacity.

Differential productivities between advancing and declining industries accentuates the problems of the latter. Occupational wage rates advance in the growing industries, for this is where technical progress is most likely. These wage increases are transmitted through the labour market to the declining industries, accentuating their problems and structural unemployment associated with them.

(c) Regional and Area Problems

When a declining industry happens to be concentrated in a particular region, we may have a region which is always worse off with respect to employment and income than the rest of the economy. But it is quite possible for a region to be declining, or lagging, behind the rest of the economy, with or without the added drag of a declining industry. Such a region is the eastern maritimes of Canada, including eastern Quebec. Part of this problem stems from Canada's geographical configuration, which makes it economically a four thousand mile long narrow strip. This puts the Atlantic Provinces at a great distance from Canada's major market areas. On top of this general problem, the Region has to contend with the problems of such declining industries as agriculture and coal. What is needed in the Atlantic area are major programmes of economic development, with particular stimulant to export oriented industries, combined with a concerted effort to reduce power costs, and transportation and communication cost with the rest of Canada.

(d) Foreign Trade

Canada has recently suffered from structural problems in her foreign trade, and these too add to the general unemployment problem. Canada's resource endowment is such that she has always had a great dependence on international trade to bring about the pattern of final goods which maximizes Canadian welfare. It was natural for her to export staples and raw materials and import manufactured goods. She has gradually tried to change this pattern in favour of more secondary industry and diversification in depth. United States and British investment in Canada has however always favoured the more "natural" pattern since this was complementary to their economies. Canada has nevertheless run against this trend and developed secondary industry behind general, and British Preferential, tariff walls.

In the first phase of the post-war period United States investment in Canada again favoured the resource industries of raw materials and fuels and helped build them up to very high capacity. At the same time Canadian secondary industries found easy markets for their output in a goods starved world, both at home and abroad. Since 1957 however there has been a slowing down in the demand for Canadian raw materials, while at the same time the European and Japanese recoveries have come into full flower. Canadian secondary industries found it difficult to compete, at home or abroad, with these lower cost, newly built and very efficient economies. Canadian costs were too high and Canadian quality needed to improve. Only recently has the exchange rate reduction helped to redress the cost picture to some extent, but this is no substitute for the increased efficiency and leadership needed in Canadian secondary industries.

This particular structural problem is a major contributing factor to a high level of unemployment.

(e) Capital Inflow

The heavy capital inflow, mainly from the United States, has accentuated our structural problems related to foreign trade. Capital for direct investment is usually brought in for the express purpose of expanding capacity in Canada. Capital goods soon follow the finance capital, and add to our imports. Portfolio investment, added to the direct flow, pushed up the price of the Canadian dollar, thereby encouraging further general imports, both capital and consumer goods, competing with domestic industry. At the same time Canadian exports became more costly. Added to these price effects, we also had strong income effects at times, which helped to turn the capital inflow into a current account deficit. For when the investment boom generated higher incomes in Canada, these too induced more imports. Foreign capital inflow has thus tended to contribute significantly to a substantial current account deficit over a longer period of time. It also created for us the present and future problems of servicing a large and growing foreign debt. Servicing a debt resulting from the installation of productive fixed capital may not create a particularly heavy strain on the economy depending on its ultimate destination and effect. But servicing a large debt created to facilitate the importation of consumer goods is quite another matter. Because of this servicing problem, a current account deficit today may have perpetuating tendencies through its influence on the current account deficit in the future.[1]

Opinions differ about the seriousness of these problems [113, 115, 116]. But they cannot be viewed with equanimity since they have added to our structural unemployement. Perhaps if we had searched for a way of letting the inflow build up our international reserves rather than our dollar price and imports of consumer goods, while at the same time sterilizing the reserves from creating undesired internal monetary expansion, the structural problems of the inflow could have been reduced.

Our analysis cannot support the claim that the heavy and partly autonomous capital inflow into Canada since 1957 has been generally an economic blessing,

[1] It is often argued that imports of consumer goods during a capital inflow merely release factors for expansion of domestic investment goods capacity. But do we seriously believe that Canada, a heavy importer of capital goods, was shifting resources in this way, especially during the many recent years of excess capacity and unemployment?

except perhaps for our securities markets. By then we had unemployment, and a reduced internal saving ratio because of the unemployment. We clearly had no need of heavy capital inflows, as we might have at times of full employment and an investment boom with more investment opportunities than could be met out of domestic savings. But a partly autonomous capital inflow, encouraged by generally high levels of domestic interest rates, and with no action taken to neutralize some of the economic consequences of capital inflows, appear to have added to our unemployment problem through the price and income effects discussed above.

(f) Foreign Control of Domestic Industry

Here again opinions vary about the seriousness of this problem [113–118]. However two themes seem fairly clear. Foreign control tends to prefer to see Canada's "natural" development as a raw material producer, rather than her diversified development into secondary manufacturing requiring political assistance and tariffs. A purely "natural" development could not employ fully our present and expanding labour force, although it might have if we could have developed among other things, secondary industries sturdy enough to operate without government support and protection. Given our tariff history, foreign direct investment has moved into Canada to gain access to the Canadian and Commonwealth markets. In many cases the foreign parents of the resulting companies do not wish to see them go beyond these into general world markets, for in so doing the Canadian child would compete with the foreign parent.

We conclude taking into account industrial development and world trade that foreign ownership and control of Canadian companies may contribute to structural unemployment.

(g) Technological Unemployment

It is possible for industry to develop such labour saving capital, technology and administration, that any reasonable level of aggregate demand can be satisfied by high capacity production which does not carry with it high employment. The wage rates of the employed can be kept high and advancing by union protection and growing productivity. It is merely necessary that the labour unions keep the unemployment from depressing wage rates, which they can do. The whole system can then grow in prosperous fashion for those with wealth and employment, but in a rather dismal fashion for the unemployed or underemployed.

By technological unemployment then we mean a situation where capital and technology have got quite out of balance with the labour supply of the economy, so that all that is wanted or demanded can be produced with considerably less labour input than is available. The situation could also develop that many of the unemployed would not have the capacity for reaching the high order of skills needed in the advanced technology, as we discussed above under "labour force-structural unemployment".

This is in fact the situation depicted in our econometric growth model (Chapter 10). But there seems also to be some technological component in our present structural unemployment.[1]

[1] Structural factors including technological developments appear to have contributed significantly to the post-war trend of increasing unemployment. Unemployment rose at an unusual rate of 7 per cent (compound) over the period 1946 to 1961 and at a rate of 9 per cent over the period 1953–54 to 1961–62 (compound). (Rates are based on data in Table A-1, Appendix A).

Conclusions

This chapter has attempted to bring into focus some of the major cyclical and structural problems that may confront the mature and wealthy economy. These problems stand squarely in the way of the attainment of both short-run welfare in terms of high level employment, and long range welfare in terms of a growth path which provides our society with an optimally chosen standard of living profile.

In the next chapter we shall consider briefly the nature of the economic policies which are needed to steer the economy to high employment and an optimal growth path.

CHAPTER 5

ECONOMIC POLICY FOR HIGH LEVEL EMPLOYMENT AND OPTIMAL GROWTH

A. Cyclical Problems and Aggregate Demand

We start with the premise that, for reasons of humanity, economic betterment, social welfare, aid to underdeveloped countries, and defence, democratic societies want both high level employment and optimal growth. We assume that these are social goals, and that the economists' job is to discover the economic ways and means, or policies which will steer or navigate the economy to their direction.

By high level employment we may recall that we mean the maximum employment ratio that can be reached without generating inflation. To make a somewhat arbitrary definition, we may define inflation as a rate of growth of the price level of GNE of more than 2 per cent per annum. High level employment should be possible with an employment ratio to the civilian labour force of 96 to 98 per cent. In fact, given a climate or policy of wage and price restraint within the boundaries set by productivity improvements, it should be possible to reach the 98 per cent level in most countries.

With regard to an optimal growth path, we recall that there are several such paths. We have at this stage of our thinking, selected three among the possible paths, as prototypes with optimal qualities. Economists in the future may discover even better possibilities. The three selected were called the *Golden Rule, Generation Optimized,* and *Free* growth paths. The choice among these three is a matter for general social decision given all of the information about them which the economist can provide. For the three paths involve an ascending degree of government influence on the saving ratio s. In the interests of public understanding and support of the policies to be taken, it would accordingly be both proper and necessary for society to have made the basic choice of the path to be followed.

As we study the policy requirements for our dual goal of high employment and optimal growth we shall consider each of these three paths in turn. Before we begin this, however, it seems worthwhile to raise the question of whether the two goals are complementary, antagonistic, substitutes or independent.

Relationship Between High Employment and Optimal Growth

High employment stands on its own as a social goal, on humanitarian, ethical and social grounds, irrespective of its relationship to growth. The alternative means the loss by a portion of our society of participation in production, consumption, and of leading a satisfactory way of life. Our first task is to examine any possible connections that may exist between the level of employment and growth. We do so by looking at observed data before exploring theory.

Examining recent Canadian history (Chapter 6) we find that periods of high employment and rapid growth tend to coincide. There are exceptions. For example the bumper crop of 1928 and 1942 tended to accentuate growth in these years, at the expense of appearances for the subsequent year. But in general the rule holds, at least to the extent that we can, with casual inspection, separate out the growth rate from the business cycle.

However, it must be admitted that our Maritime region has grown along with the rest of Canada, despite a persistent, chronic unemployment. Also we can point to Italy as a country which seemed to have permanent unemployment because of a structural imbalance of population and resources. Yet postwar Italy has had vigorous growth despite this unemployment, though the employment situation there has improved over the last decade or so.

Finally, we can look ahead to the projections in Chapter 10, using the econometric model prepared for this study. Conditions were found to exist in this model which would yield a reasonably adequate rate of growth with rising levels of unemployment. Here the situation was growing technological unemployment combined with sustained wage rates and aggregate demand.

Evidently then it would be premature to argue that high level employment is always essential to obtain a reasonable rate of growth.

Let us next consider the converse proposition: Some minimum rate of growth is necessary to sustain high level employment. Here theoretical considerations do put us on a little firmer ground. Applying our basic growth equation,

(1) $\dot{O} = y_L \dot{L} + y_K \dot{K} + \dot{A} = y_r \dot{L} + r(s-dk) + \dot{A} = (1-rk)\dot{L} + rk(sp_K - d) + \dot{A}$

we see that output must grow at a sufficient rate to absorb the growth in labour input, the stock of capital and technical progress. If capital growth were held at zero, or capital stock were let run down to 0, $\dot{O}$ would ultimately have to become equal to $\dot{L} + \dot{A}$ to maintain high employment. Alternately, if capital grows at the same rate as labour, so that we have no capital deepening, we have $\dot{O} = \dot{L} + \dot{A}$. $\dot{O}$ could of course become zero if technical progress became retrogress with $\dot{A} = -\dot{L}$; or if $\dot{L} = \dot{A} = 0$; with high employment still maintained. But these are quite unlikely situations in modern economies.

Hence we can feel confident in saying that we do need a minimal rate of growth of output to sustain high employment. Under average Canadian conditions 1926-61 such a minimal rate would have been of the order of .008 + .017 = .025.

However, we originally posed the question of the relation between high employment and *optimal* growth. The theoretical and empirical background which we have prepared does permit an unequivocal answer to this question. As long as population is in optimal balance with resources (no structural problems related to surplus population), then any optimal growth path requires continuous high employment. For even though it may be possible under special circumstances to achieve as high a growth *rate* with unemployment as with high employment, it is not possible to achieve as high a growth *path*. We take it as axiomatic that a standard of living time graph, growth path or profile which is everywhere higher than another, is superior to that other. In fact, over a generation, a high employment path could have lower growth rates than a corresponding unemployment path, and still be superior. This is not of course a likely situation. The high employment path will usually have growth rates at least as high as any corresponding unemployment path.

Economic Policy for the Free High Employment Growth Path

Since the achievement of this growth path requires minimal influence of the saving ratio on the part of government, it seems appropriate to begin our policy analysis here. The essence of the free path is that the members of society make individual free market decisions, based on market values of wage rates, product prices, and yields on savings, on the variables which will ultimately affect growth rates. The most important of these variables are participation rates, hours of work and the saving ratio. In order for these decisions to be truly and democratically free, however, a certain environment is necessary. This "free" environment must include the following conditions. Firstly, there must be high employment; secondly, there must be an equitable or optimal distribution of income; and thirdly the general public must be reasonably aware of, and have adequate access to, the true yields on capital.

We have already analyzed in previous chapters why this environment is necessary for free and democratic decisions, and for the development of mass markets. It is also important if workers are to have the attitudes that make for high production and socio-technical progress. This is the environment which economic policy must produce if the society has chosen the free growth path as one of its goals. With respect to the yield on capital we can merely pause to suggest that capital markets be studied to determine their efficiency [104, 117] and to see if a sufficient proportion of the true yield on investment is being passed on to the general public. For only when this is so is society making its best free decision on saving. The main policy problems for us to discuss here then is that of high level employment.

Policy for High Employment in a Short-Run Context

We have already discussed the mechanics of employment in the previous chapter. The more detailed and empirical representation of employment theory is

found in econometric macro-models of the complete economy. These are essentially general equilibrium systems among macro or aggregated variables for the total economy. (Cf [89 – 95] and Chapter 9). Let us here review briefly the short-run or static theory, quite apart from any dynamic or growth considerations. The level of output and employment, we recall, is determined by the strength of aggregate demand in relation to aggregate supply. Effective demand, supply and employment are determined where these very aggregative functions meet or come into equality. Since aggregate demand is composed of national consumption and national investment, it is the effect of these two demands combined, for given supply conditions, which determine effective output and employment.

We also recall that, since a large proportion of saving and investing decisions are made by different people, and since saving tends to be fairly stable while investment tends to be volatile, planned saving will seldom be equal to planned investment. But then as demand and supply are brought into equality to form effective income and output, this same process brings effective saving and investing into equality. At high employment the level of saving determines how much investment can be made, while with unemployment the level of investment determines how much saving can be made.

If the economy is at high employment and investment plans are lower than saving plans, then planned consumption plus planned investment are less than high employment consumption and investment. Effective output and employment fall. Conversely, if planned investment is greater than planned saving, planned aggregate demand is greater than high employment effective demand. We experience pressure on output, and inflation.

There are equilibrating mechanisms in the aggregate economy which may at times work to maintain stable high level employment.[1] These are the labour market (wage rates), the goods market (prices), the money market (interest rates) and the foreign exchange market (exchange rates). But these have all proven to be too slow or too ineffective to achieve high employment within any reasonable time. It has accordingly gradually devolved upon the central or federal government to provide the necessary governor mechanism to equilibrate the economy at high employment. Indeed, there is no agency in a society other than the sovereign power, representing all interests, which could logically or effectively take on this vital role.

In an economy where individuals and firms make their own decisions about consuming, saving, production and investment, the government can still exert a powerful influence on the outcome of employment and output. It can influence the flow of exports and imports through its general commercial policies, duties, subsidies, quotas, influence on the exchange rate and exchange controls where necessary. Through its control of the money supply and public debt, it affects general liquidity and money interest rates in the economy. These undoubtedly affect consumption, saving, output and investment plans, especially

[1] This is the classical argument, but it is still based on theory as yet largely untested by econometrics.

if large changes are made. But more econometric study is required to determine and assess adequately the effects and elasticities of fiscal and monetary policies.

An area where government influence on the economy is much stronger and more direct, however, is in its own spending on consumption and investment. Government has become a large producer of services which are consumed collectively by the society, and which as a rule provide major external economies (to be discussed later). Such services include education, political and administrative government, defence and so on. To provide these services government must hire labour, purchase materials and make extensive investment in buildings, construction works and machinery – social capital.

As our society and international relations become more complex, government has been providing increasing relative and absolute amounts of national consumption and investment. In 1926 public consumption (excluding defence) was 10.2 per cent of national consumption (Chapter 6), and government investment was 11.4 per cent of national investment. By 1961 these proportions had become 13.2 per cent and 22.6 per cent respectively.

It is accordingly in the direct determination of aggregate demand that government can exert a major influence to steer the economic machine, to assist it in its expansion and hold it at high employment. Let us suppose that for a particular year government has estimated with an econometric model, general forecasting techniques and a thorough survey of all investment intentions, that private investment is likely to be a certain amount and private consumption is likely to be at a given level. These demands plus tentative government plans, produce an aggregate demand below high employment potential supply. This implies that planned high employment saving is greater than planned investment. A government accepting high employment as a national objective has two broad choices. It must either raise the level of investment or reduce saving and bring up consumption, until aggregate demand is at a sufficiently high level. It can of course use a combination of these broad policies, but to present our case clearly let us assume that it will choose one or the other of these simple alternatives.

In order for government to choose to increase investment, it must first ascertain that adequate investment opportunities are available in the private sector, the public sector, or both. Suppose that it seems more appropriate for public investment to carry the advance, then government must have already prepared a list of desirable public projects, on which it can draw in short order. These projects need to be pre-arranged on the basis of social priority, with each one also labelled to reveal the industries it will predominantly affect in terms of demand, and in terms of complementarities and other external economies of supply. Investment projects might be in such fields as education, health, welfare, national parks and recreation, roads, bridges, harbours, aiports, slum clearance, city traffic congestion, and pollution of air and water.

If, on the other hand, there are still some investment opportunities in the private sector, as a result of recent innovation and development, government may

also decide to help these along through monetary and financial encouragement. In financing such policies, government would be drawing on analytical work done by an industry branch which maintains a continuous survey of all industries in the economy, and does research to discover trends in demands and in technology, which, from an over-all vantage, would assist industries to make rapid and planned adjustments to these changes. The monetary and financial measures taken might include increasing the money supply, reducing interest rates, aid from the Industrial Development Band, and special tax incentives to investment, expansion, integration and research.

Suppose alternately that the government feels that the situation calls for expanding consumption rather than investment, to make up the demand gap contributing to unemployment. This means that the national saving-investment ratio s is to be reduced. The increase in consumption can come partly from the private sector, and partly from public consumption. The latter is of course under direct government control. To expand this area intelligently, government again needs an array of useful spending projects, this time of a non-capital nature, and labelled according to social priority, and according to the main industries that will be affected by the implementation of each programme. Knowing the industrial situation through its industry analysis branch, government can select enough projects or expand existing programmes to fill in a portion of the employment gap.

To engineer that the remaining share will be taken up by private consumption, government has the basic tools or instruments of reducing taxes and increasing transfer payments. Reductions of personal income taxes, especially on lower incomes where the marginal propensity to consume is high, combined with a reduction of sales and excise taxes, will stimulate private spending and should thereby increase general welfare. Increases in transfer payments to persons in low income brackets will achieve the same results to even greater degree. Here in particular each extra dollar of income is likely to be fully spent, and hence the marginal propensity to consume tends to be unity.

Whether the government chooses the investment road, with higher saving ratio, or the consumption road, with lower saving ratio, to bring effective demand up to the high employment level, it may incur deficits. The investment road involved increased spending by government, with no apparent increase in government disposable income (tax and other revenue, less transfer payments to the private sector). The consumption road involved both increased spending and a reduction in government disposable income. These deficits, however, are not likely to be as large as they would be if the programme fails, or if no policy is attempted at all. The economy suffering under depression and unemployment is notorious for its large deficits. The economy of high employment has buoyant revenues, lower transfer payments, and usually has a surplus. (Cf. National Accounts, and Chapters 6 and 10; Appendix A). In any event, small and moderate deficits do not constitute an economic problem, and will be discussed later in this chapter. And, barring special circumstances, e.g. wars, natural disasters, major international economic disturbances, these are the worst that should be encountered on the free growth path, once it is established.

So far, we have looked at the general nature of policy to achieve high employment today, without worrying about the corresponding problems of tomorrow or the day after tomorrow. Hence our analysis could be called short-run or static. Now we must face up to the facts that our analysis of what is happening in the economy is delayed by the lag in statistical measurement, that our policy plans may be delayed still longer, and that the response of the economy to policy decisions may reveal varying lags in different sectors. Thus we see that a completely static analysis will not do in the real world where the economy is subject to fluctuations, cycles and growth. We must plan ahead so that our policy will be right for tomorrow, and the days after tomorrow. Our static analysis is accordingly only useful as a starting point.

Policy for High Employment in a Dynamic and Growth Context

In statics we consider only one equilibrium solution of an economic system or a model of it. In dynamics we study the sequence of equilibrium solutions from one time period to the next. In so doing, we trace out the time graph or path or profile of each important economic variable. Because of the lags in analysis and policy mentioned above, we must be able to predict these time paths far enough into the future to be able to rendez-vous policy effects with the appropriate economic conditions. Otherwise, policy might reinforce rather than dampen economic fluctuations. We must accordingly be able to predict the current growth trends, cycle movements, and exogenous influences on the economy. For these purposes we must make use of general economic analysis, time series analysis and econometric models. With the econometric models especially (cf. Chapters 9 and 10) we can test for the quantitative effects of any number of alternative policies in our search for the best one.

Policy for high employment in the real, dynamic and changing world must take especial cognizance of the growth aspects of the economy. It will want to consider the rates of growth of the population and labour force, and any changes in the latter as a result of changing age patterns in the population. It will also want to consider the rate of growth of technical progress. For while this progress is essentially an economic blessing, it can create technological unemployment. Economic policy in a growth context should be so formulated as to deal effectively with this unemployment problem.

The policy to attack this problem can have two prongs. One prong is to expand over-all demand commensurate with the growth in potential supply. This can be done via the consumption route or the investment route, or some combination, as seems appropriate. The other prong is to reduce average hours of work h in the economy. Through reducing h we reduce labour input L and its growth rate. This offsets to some extent the expansion in the supply of goods generated by technical progress. Historically, our society has chosen a combination of these two prongs, as technical progress has proceeded. We have had both an ever increasing standard of living, and ever reducing hours of work (cf. Chart 6, Chapter 6). But we have not in the past been able to make this adjustment smoothly and without severe unemployment at times.

Finally, our dynamic policy must grapple with perhaps the most vital and difficult area of all – investment and the stock of real capital. In our previous analysis we have seen that while investment helps solve our employment problem today, through its effect on demand and the multiplier, it adds to our problems of obtaining high employment tomorrow. This presents us with a dynamic and growth problem *par excellance* in the field of employment and one with which the static analysis is simply not equipped to cope. For today's investment moves into the stock of capital and provides us with increased capacity to produce for many tomorrows (the productivity and durability of capital goods). This sequence is readily seen in the structure of the econometric model of Chapter 9.

As long as there are abundant investment opportunities as a result of recent innovations and development, and with the support of adequate demand for final goods, this productivity aspect of investment creates no problem. Investment can be encouraged to the full extent of the high employment saving ratio and the capacity of the investment goods industry. It is when the opportunities created by innovation have been nearly filled in that the dynamic aspects of investment start to create a problem. For now each piece of capacity added to the system generates increased income and hence saving for tomorrow; while at the same time it reduces the need for further investment tomorrow.

Ultimately the economy must content itself with horizontal investment to match the growth in labour input, until a major new innovation comes along. It is in such periods that government policy is most needed. Its first job is to foresee these periods well in advance, through its branch of industry studies. One of the key functions of this branch should be to keep track of investment opportunities, industry by industry. Then as the economy approaches a period where little more than horizontal investment is needed, government must be prepared with policy measures to counteract what might otherwise bring a serious reduction in levels of output, employment and incomes. For if the investment ratio falls well below the high employment saving ratio, unfavourable results follow affecting the economy as a whole.

As a situation like the above develops initial government policy might be to encourage all possible private investment through low interest rates and tax assistance, so that no investment opportunities in the private sector will be passed by. Then in preparing further and more direct policy, government might first decide if there are still good growth promoting investment opportunities in the public sector. These may be available from a carefully prepared list of constructive public projects awaiting implementation. If these are available in sufficient numbers, then it may be possible to maintain the saving ratio at the level already freely selected by the society. Putting the right amount of these projects into operation at the right times will maintain both the highest level and slope (growth rate) of the free growth path – the former (level) through high employment, the latter (slope) through the high saving ratio.

If, on the other hand, there are not enough such projects to achieve this optimal situation, the next alternatives can be chosen. These are to reduce the national saving ratio, or to reduce hours of work, or to devise some combination

of these two policies. Here the econometric model can be of specific assistance for selecting appropriate values, quantities and combinations for the final programme. We have already outlined the nature of policy for reducing the savings ratio. This involves the stimulation of consumption, both private and public. Whether priority is given to private or public consumption depends upon the needs of the times. If it is decided to reduce the national saving ratio by stimulating private consumption, then tax reductions and increased transfer payments will be called for. If on the other hand it is decided to expand public consumption, then some projects already begun by government might be expanded, and new projects high on the priority list might be set in motion. Some of these may be growth promoting, as in the fields of education, health and basic research.

Encouraging reduction in hours of work is a new kind of public policy which has not received much attention. The theory on which such a policy may be based is briefly as follows. In the situation depicted above, the flow of saving at high employment would begin to outrun the flow of investment, and first undesired inventories, and then unemployment, would start to appear. To prevent this from happening we can either reduce the saving ratio, or reduce the supply flow to which the saving ratio is applied. Either way would bring saving and investing back into balance. The supply flow can be reduced by lowering hours of work. This must be done gradually and in planned phasing, for in itself it increases business costs of production. It is only to the extent that these costs are offset by technical progress that such a policy is feasible.

The actual research and implementation for such a policy might pass through the following phases. Having determined that saving at high employment is going to run ahead of investment, the government proceeds, with the help of an econometric model and other economic tools, to work out various combinations of reducing s (increasing consumption) and shortening h which would maintain high employment. The shorter hours could be achieved by shortening daily shifts, perhaps with more shifts per day; by shortening the number of days of work per week for each worker, while keeping plants going a full week; by increasing vacation time allowed each worker; and so on.

The problem is then presented to the general public that government research indicates that unemployment will develop unless there is either more domestic consumption with rising material standard of living, or an increase in foreign aid, or a reduction in hours of work, or some combination of these. Alternative combinations can be estimated with the econometric model. This is designed to facilitate a public discussion of the problem faced and the alternative solution possible. After such discussion has gone far enough the government appraises that combination which seems to suit the majority weight of opinion. Government then arranges this balance between standard of living and reducing hours as its policy, and suggests that business and trade unions take this into account as they conduct their negotiations. Government might then lead the way in reducing the hours of its own staff in accord with the policy.

At the time of initiating public discussion, government might want to show how society has solved this problem by trial and error in the past (cf. Chapter 6

and Chart 6:6), and how the errors have wrought considerable suffering. Government might also want to point out that bringing down hours of work will reduce the level of the growth path, but may leave its slope relatively unaltered. Alternately if policy is directed towards the saving ratio exclusively while leaving hours alone, the tendency will be to maintain the height of the growth path, while reducing its slope or rate of growth.

Policy for the Generation Optimized Growth Path

All of the policy relevant to the free growth path is fully applicable to the generation optimized path. In fact we can consider the free path as a base, above which the generation path should be able to climb, and below which the latter path should never fall. The free path is based on the assumption that government research and policy has made the true productivity of capital adequately available to the general public, and that on this basis they make their own free decisions on what proportion of high employment income they will save and invest. This still left a certain residual decision necessary on the part of government regarding the appropriate adjustment of national s to close any unemployment gap. The generation path assumes that government goes much further in its research, and analyses the effects of different saving ratios on the standard of living of the society over a long period of time, say, thirty years. This research might begin by establishing the upper limits on s, which in the shorter run would be determined by the availability of investment opportunities, and the capacity of the capital goods industry, assisted by imports. This would be one of the functions of the branch of industry studies. The longer run upper limit on s will be determined by the availability through time of investment opportunities. This in turn will depend upon the pace of innovation, development and socio-technical progress. Government itself may adopt policies which would increase this pace.

Such policies would include increased aid to education, health and basic scientific research. These are all fields with high external economies and hence, as will be discussed below, fall naturally into the government sphere. Government aid to basic scientific research is of special relevance in stepping up the rate of technical progress. Private business will not engage in this research to the extent that would be socially beneficial, because the results of such research will benefit a wide range of other firms, and will only occasionally be of direct benefit to the firm paying for the research. This research has large external economies, and if it is not assisted by society in general through its government, it is likely to be carried on at a much lower than optimal social level. Government economic research could at the same time study the advantages to be gained by encouraging more rapid substitution of capital for labour, and by searching for more non-neutral, capital-using and labour saving innovations. The substitution effect already goes on apace in the developing economy as the standard of living increases, and labour becomes increasingly costly relative to capital. All such developments increase the availability of investment opportunity, but must be accompanied by strong demand if they are not to create unemployment.

Having established the short and the longer run upper limits to investment opportunities, government research next needs to turn to the analysis of the effects of different saving ratios s on the time profile of the standard of living. This research would need to be done with a thoroughly tested and well behaved econometric model. Such tests could be run with various fixed saving ratios, and then with variable saving ratios changed to take greater advantage of the time path of investment opportunities. The model used for this testing would of course incorporate all of the expected trends in population, labour input, and technical progress.

Given these conditions, each potential time profile of s would establish a corresponding time path of aggregate consumption per capita or, $C^n/N = c^n$. This is our simple estimator or proxy for the standard of living. It should then become a matter of democratic social choice, still assuming an equitable distribution of income, as to which thirty year time profile of c^n is to be chosen. To help narrow the choice down, presumably only profiles with maximum area under them would be selected. Among these, any which ran for long periods at constant or declining standard of living, would almost surely be rejected. This would leave the final field of selection open to only those paths with highest area, and with standard of living continuously rising except for short periods where it may level off or decline, in the interest of achieving an even greater rate of growth in the future. Such periods might have a maximum duration of three years. The final selection, among closely contending paths at the top of these tests, might be made after a suitable period of public discussion.

It is now that the basic difference between the free and the generation growth path comes into play. For once the generation optimized growth path has been selected, government must deliberately apply its fiscal and monetary tools to bring the national saving ratio s to its preordained value appropriate to the path. It may thus have to manipulate the saving ratio to some value quite different from the free value, but it will be doing this with complete public choice and knowledge, and hence with public support.

Under this system an approach is made to maximizing the material economic welfare of a generation. In order to allow for unexpected changes in the pattern of investment opportunities, and in technical progress in general, while at the same time protecting the interests of future generations, the thirty year projection and plan could be completely revised for a new thirty year period, at frequent intervals, such as every three years.

Policy for a Golden Rule Growth Path

According to the theory of the Golden Rule path, the society must adjust its saving ratio (at high level employment) to equality with the share of capital earnings in output. This must be done as soon as possible, and when it is achieved the earnings of capital are all being reinvested in capital. If there is an abundance of investment opportunities the economy experiences disequilibrium growth with

capital growing faster than labour or output. Once the investment opportunities from innovation are used up, the only investment left is based on growth. We then reach a golden-age equilibrium growth turnpike, where capital and output grow at the same rates. This growth path, through both disequilibrium and equilibrium growth periods, carries with it the highest possible growth rates of real consumption per capita or standard of living. At least this is the apparent meaning of our preliminary theory on this subject of optimal growth paths. If we maintain high level employment of labour and capacity throughout the composite path of disequilibrium and equilibrium, presumably we have a path of both maximum level and growth rate. During the approach to the turnpike it would appear to be advantageous to build up the capital/output ratio k until the share of capital rk was the maximum attainable for the technology. For then maximum k would help to create the growth path of highest level, while maximum rk = s would give the maximum slope to the growth profile. With the same arguments in mind, we might also consider testing to find that k which for given labour input at high employment maximizes $\cdot O = (1-rk)\cdot L + rk\,(r-d) + \cdot A$. (cf. (1) this chapter).

Policy to achieve this path would be identical with that in the previous two cases, except for determining and achieving the final savings ratio. Government research would first have to determine how far it could raise k until this would start to depress r the marginal productivity of capital, and then how much farther it could still go to attain maximum $\cdot O$ on the turnpike. At maximum $\cdot O$ we have, using the above relation,

(2) $\frac{dr}{dk} = \frac{r\,(\cdot L - r + d)}{k\,(2r - \cdot L - d)}$. For reasonable values of the right hand side variables,

this will be negative, so that r will decline as k is increased. The estimates of k and r and hence kr = s which produce maximum $\cdot O$ on the turnpike, would be the terminal values toward which government would aim, for the periods when opportunities for investment in major innovations were low, and investment must depend almost entirely on growth.

While the theory of the Golden Rule path may be invaluable as a sign post, indicating the way we should be going, there may be practical defects in this path. In the first place it involves a constant rather than a flexible saving ratio. It just might happen that during a disequilibrium period when investment opportunities are abundant, it would pay, in terms of a generation standard of living profile, to invest at a higher rate for a few years than the Golden Rule rate. A wealthy society could afford to do this. This is because such a society earns much "profit" on human capital invested in education and training, and this profit is included in wages and salaries in our national accounts. Some of this profit could be invested in physical capital at times of exceptional investment opportunity in addition to ploughing back all of the return on physical capital into more such capital.

As a second point of doubt, the Golden Rule rate of saving seems to be very high to attempt to maintain over a long period. Of course if the investment opportunities exist at the outset, and through them and government policy k can be

increased to the appropriate level, investment will be sustained on the turnpike by growth itself, operating in conjunction with the high k.[1]

Perhaps it is sufficient to suggest that in doing the research for the generation path, government also include in its alternatives various Golden Rule paths including that one which has maximum $s = rk$, maximum $\dot{O}$, and that one with k and r which maximize height and slope of, or area covered by, the resulting growth path.

In this way all Golden Rule paths are in the running with all generation paths, and become subject to social choice on the basis suggested above.

B. Structural Problems

The major structural problems of the Canadian economy were discussed in Chapter 4. It is clear from this discussion that the policies above, related to aggregate demand, high level employment and optimal savings ratios, could not be carried out successfully in the face of these structural problems. Hence simultaneously with developing all of the cyclical-growth policies above, government must be doing research to find the policy solutions to the structural problems of the economy.

Essentially this means first finding out in what ways the product pattern, industry pattern, and labour skill pattern need to be changed to meet alterations in domestic and international demands and opportunities. Individual firms, industries and workers may not be able to see the broad trends on their own because of limited research opportunities. Government must accordingly get the results of this research through to the appropriate economic units where it is needed.

The next step is to encourage rapid change and flexibility in the economy by assisting those firms and workers who need help in making major adjustments. Since this flexibility is of advantage to the whole society, it carries with it external economies. It is for this reason that it is logical, and beneficial to society if government assists with these major adaptations. Also the costs to the individual firm or worker may appear too great relative to their individual gains or current resources. When this is so the adaptations are slowed down, and are not carried through to their optimal level by economic units acting only with their own resources.

The assistance provided by government could take the form of advice based on research, financial help, and retraining aid in the case of workers. Such retraining can be done in firms, or in institutes of technology, or in the general educational institutions of the country.

When we come to the depressed regions of the economy, government policy must be based on working out an optimal industrial development based on local resources, potential export markets, and transportation costs. Then it must

[1] $GI = dK + \dot{O}K = (d + g)\,kO.$

supplement this by a concerted drive to produce low cost and fast transportation. The peculiar geographical-economic configuration of Canada gives a high priority to this latter policy.

With respect to the recent large capital inflow, government will need to carry out research to see to what extent improvements in the Canadian capital market will improve domestic saving, to what extent improvements in the Canadian competitive position will prevent the excessive imports which create unemployment, and to what extent the capital inflow can be sterilized from causing either an inappropriate increase in the exchange rate or domestic inflation. Both of the latter of course contribute to excessive imports. Clearly we must gradually eliminate the balance of payments deficit on current account as part of our policy of maturing, and of coping effectively with Canadian structural problems. As part of our policy in this direction we should definitely arrange that government finance at all levels be obtain on relatively easy terms in Canada. Borrowing by governments from abroad helps to increase our present structural unemployment related to imports, while at the same time this intensifies our balance of payments problems for the future.

We must also try to develop sufficient entrepreneurial and technological skill and daring in Canada so that we can gradually buy back control of a good part of our industry and natural resources which have fallen under foreign domination. We have seen that some of this foreign control contributes to our structural problems. In this regard we must try to become sufficiently receptive to new and better ways of doing things, and to new technologies, to offer sufficient incentives to our best young brains to stay in Canada.

In the area of structural problems, but vitally related to cyclical problems, is the matter of having some flexibility in the capital goods industries. In this regard government could conduct industrial research to see to what extent some parts of the capital goods industry can be shifted to consumer goods, and conversely. We cannot shift easily from high to lower saving ratios and back again, if we encounter a structural problem of lack of flexibility in this respect. However, to the extent that we engage in longer range planning through following a generation optimized growth path, revised every three or so years, the need for such flexibility will be reduced. The capital goods industry could then make longer-range plans with more assurance of not having to make large short-run alterations.

Finally, when government finds its economy faced with technological unemployment, as industry experiences technical progress at a faster rate than demand will expand, it seems appropriate at this stage of history for government policy to expand demand. Such demand could be channelled into areas where we are still socially deficient – into domestic welfare, social work, education, health, recreation and city improvement, plus the social capital which these areas need, and into foreign aid to underdeveloped countries. When all such deficiency areas have been taken care of, the policy for preventing technological unemployment will then become to encourage increased leisure, and effective use of leisure time.

Role of Government in the Modern Free Economy

It is a major hypothesis in the present study that the economic units in our system cannot be truly free without some optimal level of government intervention. An unemployed man is not free in the sense of being able to allocate his resources to maximize his welfare through his own choices, if he is unable to make the initial step of being able to exchange his labour in the market. The same can be said about a business firm, caught up in cyclical or structural depression and in danger of losing its capital. Only economic units who are able to make their own decisions within an environment of high employment and growth can be considered as free.

Such an environment can only be maintained by a central government in co-operation with other governments and all major sectors of the economy. The effectiveness of government measures become much more powerful when they include all three levels – federal, provincial and municipal. In fact their strength, in terms of the total of public consumption and investment, is at least doubled with this aggregation; and it is the total of government efforts which has been implied throughout this project.

It follows that on matters of high level employment and growth, government policy to combat cyclical and structural problems must be the policy of all three levels of government, working together. Our policy for achieving these national goals would be much less likely to succeed if the separate provinces went their completely separate ways on all matters of taxing, spending, investment, timing, and on the solution of structural problems. Problems which are essentially national in scope could never be solved by piecemeal methods, often working at cross purposes. However, although agreement of all levels of government is necessary for carrying out national policy on these vital matters, this need not prevent provincial governments from tackling their own related local problems at a level over and above the concerted national programme on these same problems.

The role of government has been expanding in the modern economy, and so has the gross value of its services as a proportion of GNE. Since this study bases its main hope for economic health on government policy, perhaps some discussion of this phenomenon is in order. Let use begin with a very brief review of the necessary functions of government. There are certain social and economic needs which, if they are to be done at all or are to be done at their optimum level, must be done by government. Firstly we have activities which are monopolies by their very nature, and yet are needed by the whole society. Here we may think of the administration of government itself, the legal system, the money system, international diplomacy, defence, roads, water supply, and the national economic policy we have been discussing. As the world society and technology become more complex, more of these things have to be done. Hence government must expand, and all that we can ask is that, as it does so it also strives to operate as efficiently as possible. This can only be achieved if government personnel are motivated by the highest ideals of public service.

Next we may consider another class of activities which could be carried out in the private business sector of the economy, but which would not be carried out at optimum level there. These activities involve the production of goods (including services of course) which carry with them extensive *external economies*. An external economy is said to emanate from a good when its consumption by one individual (or firm) confers benefits not only on him, but also extends benefits to many others beyond him. For example a rich man might hire a small private army to defend his estate, but the presence of this army acts as a defence for other estates. Or a shipping company might put up a lighthouse on a dangerous shoal to preserve its own ships, but in doing so it also saves the ships of other companies. Each of these purchases carries with it large external economies to others. Similarly a purchase of education by one individual may benefit him, but may also be of great benefit to society in general.

But goods which carry with them large external economies are not likely to be purchased by individuals to the extent to which they would be most socially advantageous. The marginal benefit to the individual may fall to equality with marginal cost to him while there is still extensive marginal social benefit to be gained if the individual purchased more of the good. Under these conditions it will usually be socially advantageous for government either to produce the good itself, or to partially produce it itself and subsidize the balance in the private sector. If this increases the scale of output of the good and thereby creates lower costs, the social gain in increasing output until marginal social benefit falls to equality with marginal social cost may be enormous. We have seen this very thing happen in modern public education, and nowadays such education is coming to be recognized as one of our most valuable social investments.[1] On the purely materialistic side, it is the main source of the technical progress in our growth analysis.

Many of the first class of goods, which are best produced by monopolies, also fall into the second class, where external economy is the criterion. It is these two overlapping classes of goods which create the role of government. Again, as the need for goods of these two classes increase because of the increasing complexity of the world, society, and technology, we can expect the relative scale of government operation to increase.

This relative scale could not increase indefinitely in a free society, of course. There will always be a large class of operation to be done which do not fall into the above two classes. These are best done by private business enterprise, and the relative scale of this sector must be kept sufficiently large to maintain political democracy. Thus while the relative scale of government is now growing, it is presumably finding a new equilibrium of functions relative to the private sector, where this proportionate growth will stop. In fact, in the projections

[1] In the national accounts which we present in Chapter 6 and Appendix A we still treat the *current* costs of education as consumption. This is in keeping with our treatment of wages and salaries as labour income, when actually this total contains much that is of the nature of interest, rent and profit. The basic division in the national accounts is not between income earned by labour and capital, but between income paid for the services of people and income paid for the services of physical capital and entrepreneurship.

with the econometric model in Chapter 10, using the equations of growth derived from the historical data, the relative scale of government begins to decline very early. While government grows in absolute terms, it does not grow as fast as the private economy.

In considering the role of government as a creator of stability and growth in the economy, it has been feared that this may mean endless government deficits. We shall conclude our chapter on economic policy with a brief consideration of this problem.

Government Deficits

Government deficit, as defined in the national accounts, is equal to all government taxes and other revenue derived out of current production, less all government subsidies and transfer payments for various welfare purposes, less all government expenditure on newly produced goods and services. Both capital and current goods are included in this calculation. If however, government capital items were treated in the way that a business would treat them, then all government deficits would be reduced, and all surpluses would be increased by the level of government spending on capital goods, less provision for capital consumption (depreciation) on all social capital. Government spending on capital goods would then become a part of gross national saving, and this is in fact the way they have been treated in parts of this project. If the national accounts for 1958 for example were set up on this basis, the large deficit recorded for that year would have been reduced to near zero, for *gross* fixed capital formation by government in that year was $1,382 million, and the deficit was $1,007 million.

It is well known from employment theory that a government deficit tends to act as a stimulant to the economy, while a surplus acts as a depressant. The former increases the spending flow of aggregate demand, while the latter reduces it. It is then developed in this theory as policy for high employment, that government taxes and revenues should equal expenditures in the long run, but that we need deficits to fight depression and surpluses in boom times to fight inflation. The government budget thus becomes a massive economic governor, itself composed of many "built-in stabilizers".

The mechanism of running a deficit is to borrow money on the security of bonds and treasury bills, from the public, the chartered banks and the central bank. Borrowing from the public does not increase the money supply, from the chartered banks may increase it by the amount borrowed, and from the central bank may increase the money supply by a money multiplier of 10 to 12 times the sum borrowed.

The theory of cyclical budgeting is sound. If things behaved according to it the public debt would have no growth trend, and would in time become insignificant relative to GNP. In practice however the public debt has tended to grow. Depression and war are of course the major causes of such growth. In the buoyant economy of the early post-war we did have surpluses and the public debt was

correspondingly reduced. But as backlog demand was made up, and the bloom went off the rose heavy deficits began to appear.

The sad aspect of these deficits, and the growth in public debt which accompanies them, is that they are largely "wasted" deficits. We can refer to them as wasted deficits, because they have not achieved their major objective, the restoration of high level employment. In fact if they had achieved this objective they would quite likely have been smaller deficits.[1] For the upsurge of the economy to high employment would have been accompanied by a buoyant increase in government revenues and disposable income (Cf. Chapters 9 and 10).

What is the reason for the failure of such large deficits to restore high employment? It is undoubtedly the lack of a sufficiently scientific attack on a rather difficult problem. Such an attack should make use of the best econometric models of the working of the economy, along with all of the other useful quantitative and theoretical tools of economics. Using these, the kinds of policy for combined high employment and growth discussed in this chapter could have been worked out. Such an attack is likely to succeed in the end, and then our deficits would become smaller or turn into surpluses. But none of them would be wasted.

To the extent that government deficits are needed to restore high employment and growth they should not be looked upon with any apprehension. In the first place they serve a vital humanitarian goal, and also when successful they increase the general strength of the economy very considerably. As we have seen, one of their effects is to increase the government security issue and the public debt. As long as this debt is held by Canadian residents, it is serviced by a transfer of money among Canadians, and does not require us to export goods in payment. This may involve some redistribution of income among residents. In addition it provides residents with a safe form of financial wealth with good liquidity and moderate return. This the economy seems to need and want. Also that part of the government security issue which is purchased by the central bank to provide desirable increases in the money supply represents a part of government deficit which costs the economy nothing. Or at worst it can be regarded as the most painless possible form of tax.

In fact as long as the public debt does not grow faster than GNP, and if it is held internally, it represents no unmanageable economic problem. Hence government could go on having deficits forever, and as long as taxes were adjusted to keep the deficit within these bounds, no major problems need arise. In this respect government is quite unlike a private business, which cannot survive under continuous deficits. For business must operate to produce a return on capital sufficient to keep the capital in its line of production. Government on the other hand operates at at cost of production, since by its nature it caanot usually sell its wares on a market, and thereby appraise the profitability of its operations. When it runs a deficit it is not covering these costs fully with taxes, and is effect deferring a portion of these taxes. Under the circumstances discussed above, this deferment or deficit can be highly beneficial to the society.

[1] Quantitative estimates of the hypothetical deficit in 1961 under successful high employment and growth policies could be worked out with the econometric model of Chapter 9. Time has not permitted.

To sum up, as long as we keep the deficits within the bounds set by the needs for increasing the money supply, and by the size of the public debt relative to the size of GNP, and keep the public debt in the hands of domestic residents only, we have no need to worry about them. We should not hesitate to use such deficits, plus whatever level of taxation is needed, to achieve our national goals of high employment and sturdy growth. When these goals have been reached and as long as they are being maintained, deficits need not be incurred. The public debt will then represent the liabilities incurred to finance fixed assets, as in any business.

CHAPTER 6

RECENT HISTORICAL RECORD OF CANADIAN GROWTH AND PROJECTION OF SOME OF THE TRENDS

Introduction

The present study of Canadian growth was meant to be essentially empirical so that the trends of the past record of this growth could be analysed, and so that these trends could then be projected into the future. Since an empirical study needs a theoretical framework to give it direction, the previous four chapters have aimed at providing the background required.

In this chapter we present the highlights of the empirical data on which our analysis of Canadian growth is based.

An empirical study of this kind of necessity requires a rather massive assembly of statistical and institutional historical data. The data for this project have been assembled in Appendix A of this study, entitled ''Basic Historical Data''. The tables of data are there arranged into six sections A to F. Data in these tables will be referred to and located by section, table number, and column number, in that order. Thus the reference C–2–6 means Section C, Table 2 and Column 6 and is found to refer to GNE (Gross National Expenditure in millions of 1957 constant dollars). The data were designed to permit analysis of historical patterns, projection by elementary methods, and finally the building of an econometric growth model for a final projection.

The year for which this historical record begins is 1926. Although the author had access to the new ''Historical Statistics for Canada'' [85] while still in process, thanks to the kindness of Professor M.C. Urquhart, and also had the work of Professor O.J. Firestone [24 and 24A] it was still impossible to carry a large number of the series required back beyond 1926. Hence it is the Canadian record only from 1926 onward that is presented and analysed in this chapter, and that is used as the basis for the projections which follow.

Broad Pattern of Presentation and Analysis

The general framework within which the causes of economic growth operate is summed up in formulas (15) and (16) of Chapter 3, and formulas (4) and (5) of

Chapter 4. Economic growth is created by labour; capital goods, that is tools, machines and construction works; the natural environment and its resources; enterprise, knowledge, and technology. It is influenced by the extent of the market and the degree to which it permits specialization and the use of large-scale technology. It can only be called into being if the demand for final goods is adequate, and it can only appear on an *optimal* growth path if aggregate demand continuously measures up to the growth in potential supply. It can be weakened currently by failure of demand and hence unemployment of resources, and through a dynamic sequence this weakening can retard future growth. For unemployment will leave in its wake a lower time profile of the stock of capital.

Taking guidance from our theory, we shall in this chapter look at the historical statistics covering "Labour", "Capital", and "Knowledge, Technology and Social Factors" or "Socio-Technological Factors". Then we shall look at the volume of output which resulted from these factors of production, and the allocation of this output to the major sectors of national demand.

What is aimed at is a bird's eye view of Canadian economic growth, in relation to the theoretical framework presented in the previous chapters.

A. Labour

Population

Population is the source of labour supply in the productive system. It is also the basis of most of the demand for the output of the system. Because of this dual role, population is doubly important as a factor related to growth. The long range trend in Canadian population from 1926 to 1961 reveals a growth rate of 1.9 per cent. But in the post-war period the rate has been of the order of 2½ per cent. This has been caused by an upward surge in fertility rates, the long-run decline in death rates, and periods of high net immigration. In the projection of population into the future made by Dr. A. Stukel (see Appendix E) the growth rate slows to a little less than 2¼ per cent, under assumptions of some decline in fertility rates (except in the youngest fertile female age group, 15–19), a continuing decline in mortality rates, and net immigration of 50,000 per annum. In the 35 years from 1926 to 1961 population (A–1–1) is found to nearly double. In the thirty years of the projection it also nearly doubles reaching 35,107 thousand in 1991.

Labour Force

That part of the population which makes its labour and enterprise available in the productive system comprises the labour force or labour supply. The size of the labour force depends upon the total population, and its degree of participation or supply in the productive system. Participation varies widely according to sex and age, and for this reason we study participation rates by sex, and for the main age groupings. The historical record of these rates is found in A–2.

The long-term trends in these rates are determined by broad sociological and technological forces, as well as by the economic influences of real wage rates, degree of unemployment, standards of living, and wealth. Certain broad trends in the historical participation rates stand out.

The general participation rate of the total labour force (including the military) to total population (A–2–1) climbed steadily from 37.9 per cent in 1926 to 42.3 in 1945. Since then it has steadily declined to 36.5 in 1961. The bulk of these changes can probably be attributed to a decline in the proportion of the dependent population composed of the young and the aged in the earlier period followed by a reversal of this trend in the period after 1945.

Looking next at the over-all participation rate of the civilian labour force relative to the civilian non-institutional population age 14 and over (A–2–2) we find a decline from 55.0 per cent in 1946 to 52.9 in 1955. Since then the rate has risen to 54.3 in 1961. This trend and its reversal is due to underlying trends in the participation of the sexes. The over-all rate for the men (A–2–5) has been consistently downward from 1946 to 1961 (from 85.2 to 80.0); for the women (A–2–5) it declined slightly from 1946 to 1950 (24.7 to 23.2) and since then it has been increasing at an accelerating pace, reaching 28.8 in 1961. This is still below the female rate for the United States, which was 36.9 in 1961.

The participation rate for the men finds its explanation mainly in the student ages and in the over 65 group (A–2). There has been a sharp decline in participation of the 14–19 age group; an increase in the 20–24 group from 1946 to 1951 (probably as veterans rejoining the labour force), followed by a decline in this group from 93.4 to 90.7 in 1961; and a pronounced decline in the 65 and over group. Here we see the needs for increased education in an ever more complex technology and society. We also see the effects of retirement financing through the growth of pension schemes. Some of this retirement is forced and may not be good for the individual or for the society. In the interests of the health and the general well being of the individual this aspect of our attitude to man's productive years needs more research followed by appropriate changes in attitudes and policies.

The increasing participation of women in the labour force is another of the striking aspects of labour force trends. It can be related to the breaking down of the sociological bars against women working, as a result mainly of two world wars. It is also related to the reduction by modern machinery of much of the heavy work of production, coupled with the increased need for office and administrative functions in our more complex productive system. At the same time home-making is lightened by equipment of an increasingly automatic nature. The main constraint left on women is child-bearing and rearing and in the younger age groups increasing education. As a result largely of the latter the participation rates in the youngest age group, 14–19 has been declining. In all other groups the rates have been increasing. The increase is modest in the ages 20–24, high in the 25–34, almost explosive in the groups 35–64, and modest in the 65 and over group.

Whether some of these trends spell good or ill for the mental and physical health of our children needs careful research. This should be followed by an enlightened policy.

The detailed participation rates by age and sex were individually projected on a graph. In the projections the above trends were continued, but were moderated when it was felt that they could not continue indefinitely at their high slopes. The net effect of this detailed projection of the rates came out to a continuation of the downward trend for men, and the upward trend for women, resulting in a gentle increase in the over-all participation rate from 54.3 in 1961 to 55.3 in 1991.

Industrial Composition of the Labour Force

Because of the limitations of time and manpower this study had to be fully aggregative, looking at the total Canadian economy as a single unit organism. Despite this general limitation there are areas in the study where a brief look at more underlying detail was felt to be necessary, to meet the broad purpose of relating Canadian growth to the health services. Labour force composition is one of these areas.

Looking at the trends in this composition we first observe the well-known decline in manpower needs in agriculture. This industry has experienced an accelerated "technical revolution" in recent years, with the rapid application of machinery, power, chemistry and biology to production from the soil. With the growth in productivity relative to labour which this has produced, and relatively inelastic demands for agricultural produce, there has been a steady exodus from the farm to the city. Workers in agriculture have declined from around 34 per cent of the labour force in 1926 to 10.3 per cent in 1961.

A second major trend is detected in the post-war period. Here we find a pronounced expansion of employment in the service industries (education, health, religion, law, government service, business service, recreation and personal service). Service employment was roughly 16.5 per cent of total employment in 1931, 16.8 per cent in 1946 and 25.5 per cent in 1961.

By contrast, manufacturing employment has changed from 26.0 per cent of total employment in 1946 (and 1948) to 25.1 per cent in 1961. During this period manufacturing too was experiencing rapid improvements in technology and in automation; output increased some 80 per cent in volume terms, while employment increased only 20 per cent.[1] (This represents a growth rate in average productivity relative to employment of 2¾ per cent per annum).

With these trends Canada is in broad outline following the general evolutionary path of development of other mature economies. Expansion into the service industries usually represents an advanced stage of maturity and affluence. In fact Canada has for some time been rated as the country with the second or third highest level of real income per capita in the world.

From Labour Force to Labour Input into Production

The labour force or labour supply is only a potential input into production. The actual input depends upon the rate of unemployment, the hours of work per week and

[1] Canadian Statistical Review, Dominion Bureau of Statistics, various issues.

per year, the degree of skill and education brought to the task, and finally the intensity of effort. There are thus many dimensions to labour input. We must attempt to see the trend in all of them.

(a) *Unemployment.* The rate of unemployment was approximately 2½ to 3 per cent of the civilian labour force (A–1–6) in the late 1920's, rose to 20 per cent or more in the Great Depression, was 12 per cent as late as 1940, less than 2 per cent later in the war, and ranged from 2½ to 4 per cent in the post-war up to 1953. With the recessions of 1954 and 1957 the rate moved to over 4 per cent and from 1958 onward has been 6 and 7 per cent. When looked at on a graph (cf. Chart 6:2) the rate of unemployment reveals an upward trend throughout the whole post-war period, with business cycle superimposed on this trend. Then in 1958 this trend itself appears to have shifted upward to what could become a continuously higher level over the long run, unless appropriate policies are applied to the solution of this problem.

The evidence suggests a hypothesis that Canada as well as the United States has had a continuous unemployment problem since 1929, the last year of the boom associated with the big automobile innovations, as well as many other factors. While we have seen a wealth of innovation in Canada during the war and post-war, during the latter period there has been no labour-absorbing innovation, comparable to the steam engine, railways, electricity and the automobile, up to 1929. The war and post-war may merely have covered over this basic problem up to around 1957. The post-war boom started out as a filling in of shortages of consumer and industrial capital goods, a legacy of depression and war. As consumer durables and automobiles filled in, to bring consumer stocks up to desired levels (now desired at higher standards than formerly, because of higher real incomes) the television boom provided further assistance. The more recent innovations of automation, electronics, computers, atomic energy, and space research stimulate employment at the outset, but eventually turn out to be labour saving. Their labour-saving effect may ultimately more than offset their capital-using effects on final over-all employment.

A further cause of this trend in unemployment is our lack of effective efforts on a broad front to be competitive in world markets, in areas other than primary products. Our recent chronic foreign trade deficit is partly due to this inertia, partly the result of capital inflow for development purposes, traditionally followed by heavy importation of machinery and equipment, and often bringing in its wake increased imports of consumer goods. These and other structural causes of unemployment have been discussed more fully in Chapters 4 & 5.

However, it is almost certain that much more than structural problems are causing the present unemployment in North America. Investment has been declining in the 1957 to 1961 period,[1] suggesting that the savings – investment - growth problems discussed in Chapter 4 in relation to the mature economy

[1] Increases in real investment have occurred in 1962–1964 so that our problem of finding increasing investment is for the time being lessened.

are operative once again. Aggregate demand falls short of potential supply because investment does not measure up to full employment saving.

Having studied this record of employment and unemployment, and having attempted its explanation, it now becomes necessary to think about projecting the rate of unemployment into the future. This is a difficult and complicated task. Without government intervention we can expect cycles of prosperity and depression. Also recent developments suggest a tendency to an upward trend in the proportion unemployed. With adequate government policy (cf. Chapter 5) we could move on an optimal growth path with minor fluctuations at a 4 per cent or lower rate of unemployment. For the projections which follow it was necessary to make some assumption about these matters. To assume a continuing rate of unemployment at a level higher than 4 per cent would involve assuming an unwillingness on the part of the Canadian people and their government to tackle unemployment problems with vigour and foresight. Such problems can be solved if we apply sufficient research and resolute policy based on the research. The following assumption was finally made. Between 1961 and 1966, governments in both the United States and Canada would tackle the problem of unemployment with determination and full popular support, institute the necessary research and policies, and bring the rate of unemployment down to a long-term average of 4 per cent. A more humane rate would be 2 per cent. Sweden, a country with considerable success in its record in these matters has been reported to aim at 1 per cent.

Only a long-term average trend is of course assumed in the projections. It is understood that unexpected fluctuations will arise from various sources, and that the business cycle can probably be only reduced in its effects and not eliminated.

(b) *Hours of Labour.* It is one of the deductions of economic theory that as a society becomes more productive and more wealthy it will choose to use part of its gains to improve its real income, and part on increased leisure. The long-run rate of decline of average annual hours of work per worker in Canada has been -0.80 per cent, 1926 to 1961 (A–1–9). This includes the effects of more public holidays given to workers, as well as more and longer vacations. The post-war compound rate of change per annum from 1946 to 1961 was -0.67 per cent, and it is this more recent trend that has been projected to 1991.

Hours of work have a significant cyclical pattern as well as the above trend. As the business cycle turns down firms prefer to put permanent and skilled staff on short hours rather than lay them off and take the risk of losing them and then of having to re-train new staff. Similarly in boom periods firms prefer, as much as possible, to work overtime using their existing staff and facilities, rather than to go to the expense of hiring and training extra workers for the period of the boom. The firm prefers to expand staff and facilities to parallel the growth trend rather than to follow the cycle, taking up as much as possible of the cycle variations in labour needs by varying the hours of work.

(c) *Skill, Training, Education, Intensity of Effort.* There is no way of directly and separately measuring the effects of these dimensions of labour input, but their combined effect is at least reflected in one of the measures developed in this study. This is the measure of socio-technological and developmental change in the production function. The variable A in the production functions measures the effects of the above human factors, plus the effects of technological advance, plus the effects of malproportion of factors of production during depressions. Growth changes in A are recorded in E–2–12, as ˙A. A itself is found in E–2–13.

The skill and education components are clearly of the utmost importance in productivity in the modern economy with its increasingly complex technology and administration. Intensity of effort is likewise of great importance to productivity and is related to morale, sense of fair play and fair pay, the skill of management, and the general state of physical and mental health of the work force. It can be assumed that this intensity starts to fall generally in the economy when the rate of unemployment climbs to over say 4 per cent. It then becomes defensive strategy on the part of labour to "go slow" and find as many "make work" expedients as possible. This may partly account for the negative values found in ˙A, preponderantly in periods of downswing and unemployment. The remaining cause of these negative values is assumed to be the malproportion of the factors of production mentioned above.

(d) *Composite of Measured Labour Input – Man-hours.* Man-hours is the composite of all of the directly measurable aspects of labour input – labour force, rate of unemployment, average hours of work. The growth trend in man-hours (A–1–10) has been ¾ of 1 per cent 1926 to 1961. The growth rate of man-hours in the first two projections is however 1¾ per cent. It is larger than in the historical period because our projected population grows faster, participation rates increase slightly, and we have assumed that the rate of unemployment will be reduced from 7.2 to 4 per cent.

We now present in Charts 6:1 and 6:2 a visual picture of the historical trends of some of the main series related to labour input into production.

B. Capital

The second main factor of production and growth is *fixed capital* – the physical tools and machinery of production. These embody the knowledge, science and technology that man has been able to accumulate through the ages. They add tremendous productivity to the supply side of the economy, especially through harnessing inanimate energy in its many forms, and substituting the mighty powers available in nature for the puny muscles of man and animals. These capital goods are at the heart of any programme of development and growth and the more rapidly they can be accumulated the higher is the growth of output and the improvement of living standards in the economy.

The rate at which capital can be accumulated in an economy depends on the gross rate at which the society saves out of current income, plus the rate of net

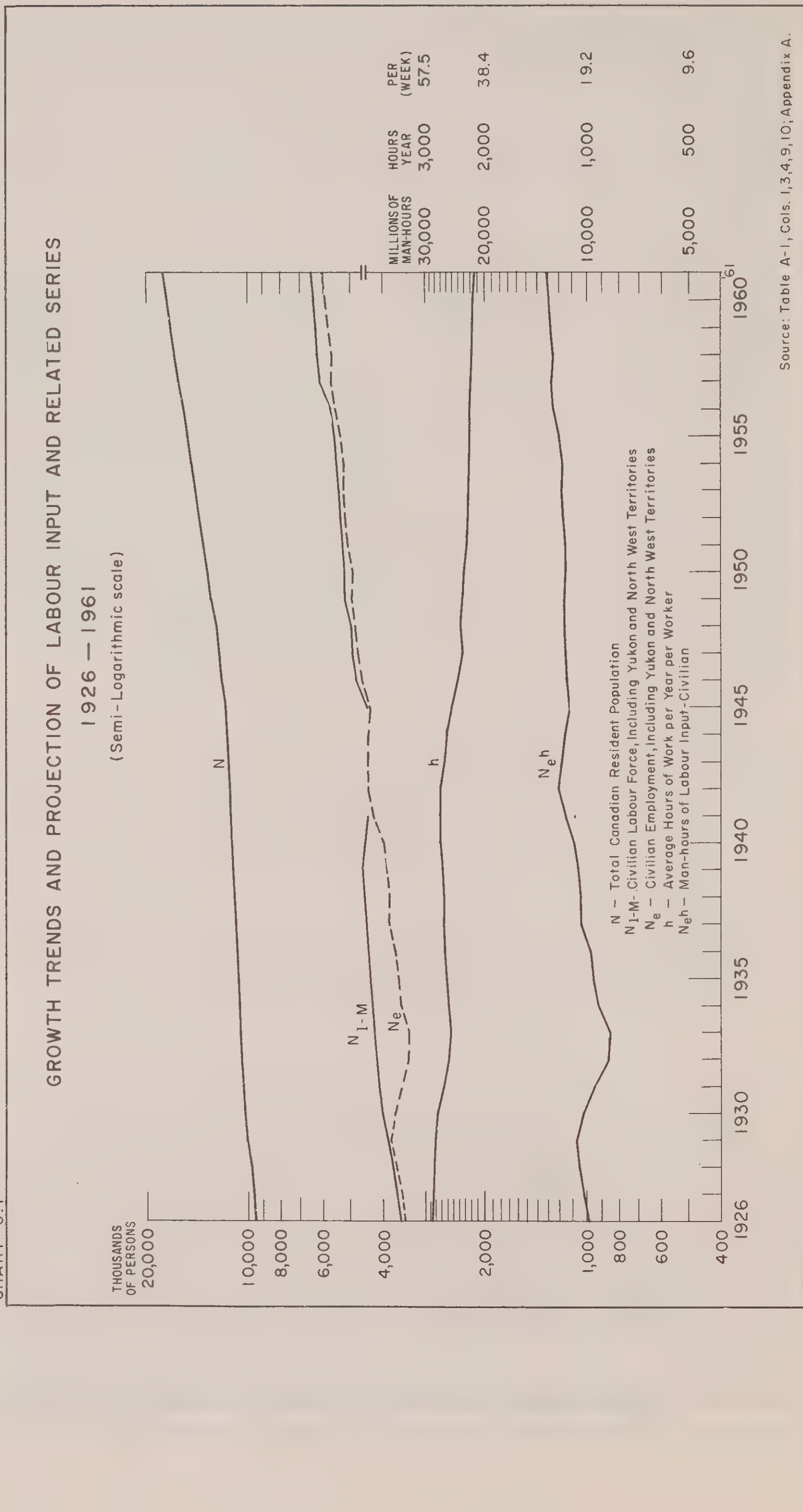
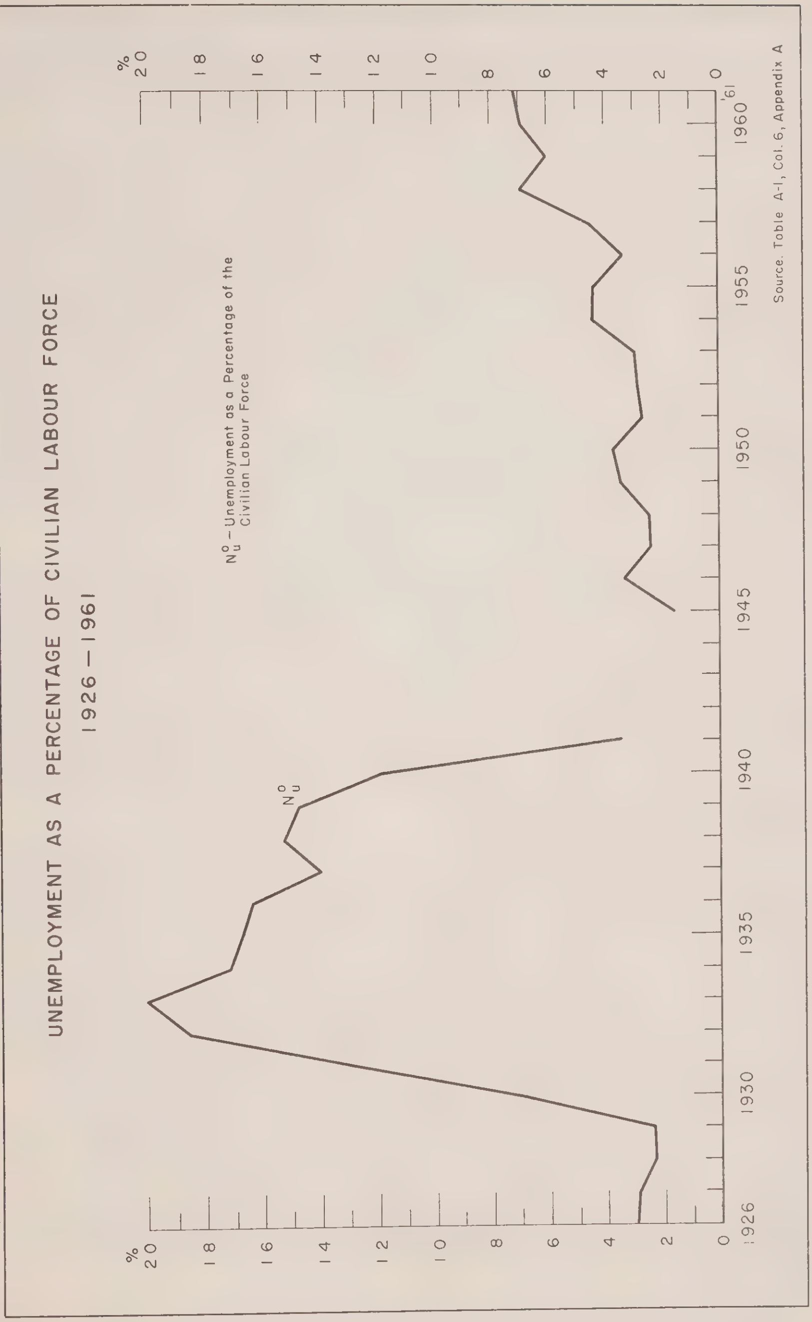


CHART-6:1
GROWTH TRENDS AND PROJECTION OF LABOUR INPUT AND RELATED SERIES
1926 — 1961
(Semi-Logarithmic scale)
THOUSANDS OF PERSONS
20,000
10,000
8,000
6,000
4,000
2,000
1,000
800
600
400
1926
1930
1935
1940
1945
1950
1955
1960
'61
MILLIONS OF MAN-HOURS
30,000
20,000
10,000
5,000
HOURS YEAR
3,000
2,000
1,000
500
PER (WEEK)
57.5
38.4
19.2
9.6
N
N_{1-M}
N_e
h
N_eh
N – Total Canadian Resident Population
N_{1-M} – Civilian Labour Force, Including Yukon and North West Territories
N_e – Civilian Employment, Including Yukon and North West Territories
h – Average Hours of Work per Year per Worker
N_eh – Man-hours of Labour Input-Civilian
Source: Table A-1, Cols. 1,3,4,9,10; Appendix A.

CHART-6:2


UNEMPLOYMENT AS A PERCENTAGE OF CIVILIAN LABOUR FORCE
1926 — 1961
N_u^o — Unemployment as a Percentage of the Civilian Labour Force
N_u^o
%
20
18
16
14
12
10
8
6
4
2
0
1926
1930
1935
1940
1945
1950
1955
1960
'61
Source. Table A-1, Col. 6, Appendix A

inflow of saving from abroad, and less the rate of flow of capital consumption through wearing away, destruction and obsolescence of capital. Capital inflow is essential to the acceleration of development in an underdeveloped country, and becomes less essential as the economy matures. Canada as a wealthy country has been able to save and invest a high proportion ($S^{n°}$) of her GNP,[1] (C–2–11).

At this point is seems appropriate to explain the concept of saving and investing to be used in our growth analysis. Basically what we must do is decide what part of total national output is consumed, and what is saved and invested as a basis for future consumption. We define Gross National Investment (GI^n; C-2-2), as equal to business gross fixed capital formation, plus physical change in inventories, plus public or government fixed capital formation for other than defence purposes. The remainder of Gross National Product (GNP) is National Consumption for civilian purposes (C^n; C-2-1) plus National Expenditure for Defence or Military purposes (G_M; C-2-4), plus the foreign trade balance $\acute{F}_2 - \acute{F}_1$ (C-2-3). G_M is of the nature of an exogenous variable, dependent mainly on international relations and events. C^n on the other hand is an endogenous variable, determined by economic and social conditions within the economy.

The Gross National Saving of the economy (S^n) would be equal to Gross National Investment, if there were no capital inflow or outflow, no foreign trade balance. We define S^n as equal to GNE less national consumption C^n less defence consumption G_M. Then S^n equals GI^n + Current Account Balance (C-2-3) + Residual Error ($-\frac{1}{2}R_2$; C-2-5), equals total gross saving of residents. The percentage proportions of GI^n and S^n to GNE are found in C-2-7-12, as $GI^{n°}$ and $S^{n°}$. Here we find that for Canada the potential combined gross national saving of persons, business and government ($S^{n°}$) is of the order of 24 per cent of GNP. But this potential ratio is only reached under conditions of full employment.

We recall from Chapter 4 that at full employment we have the classical case where the ratio of investment is determined by the ratio of saving; but at less than full employment it is the ratio of investment which determines the ratio of saving – the Keynesian case. When this case applies much potential saving (and investment) is dissipated by the unemployment and low incomes. In any period, ex post, the volume of saving of residents plus non-residents is equal to the volume of investment made by households, firms, government and non-residents in dwellings, plant, construction, machinery and equipment, and inventories, and equals GI^n.

The gross national saving ratio $S^{n°}$ was 24 per cent in 1926–28, 19 per cent in 1929, 5 per cent in 1933, 8 per cent in 1944, 24 per cent in 1948 and 1951, 19 per cent in 1954, 24 per cent in 1956. Since then it has declined to 19½ per cent in 1961. It appears then that under normal peacetime conditions in Canada, when the ex post gross saving ratio $S^{n°}$ falls below 24 per cent the economy has begun to slip into unemployment.

Neither of the above saving-investment ratio concepts is fully appropriate to the study of growth in the economy. For growth analysis it seems best to deal with

[1] Though in the last decade Canada has also depended heavily on foreign capital inflow, to which we referred in Chapters 4 and 5.

total activity within the national boundaries of Canada irrespective of ownership or claims by residents or non-residents. Productivity relationships are determined by factors of production in being, and ownership only becomes relevant when we come to deal with changes in the national income and welfare of Canadian residents. Hence for the analysis of growth we shall use Gross Domestic Product (GDP) as the national production concept. This measures the total value of output of final goods and services within the geographical boundaries of the economy. It differs from GNP by interest and dividends paid abroad to foreign owners of domestic capital (π_{di}) less interest and dividends received from abroad on account of domestic ownership of foreign capital (π_{id}). Thus,
(1) GNP = GDP - π_{di} + π_{id}. Then for the savings-investment concept for growth analysis we shall use real investment put in place, GI^n.

When we use these concepts, the relevant saving ratio becomes
(2) $s = \frac{GI^n}{GDP}$. (cf.E-1-1). It is this ratio that is meant in the theoretical parts of the present study and that is used in the projections. The differences between s and $S^n/100$ are then attributable to the interest and dividend payments in (1), and to capital inflow or outflow. There has been a continuous stream of capital inflow into Canada from 1950 to 1961 (C-2-3,9) reaching a flood tide in 1956–59. In these years s was .289, .273, .243, .248.

It is the stock of fixed capital and inventories which acts as the factor of production. The stock of fixed capital is augmented by the inflow of gross fixed investment, and diminished by the outflow of capital consumption (depreciation) arising from wear, destruction, and obsolescence.

The stock of capital for Canada was estimated as part of this project, and the results are tabulated in B-1-1-5. The estimates were prepared separately for machinery and equipment, plant and construction, and inventories. To give a complete picture of productive assets for the total economy we include the stocks held by both the private and public sectors of the economy. Only military capital was omitted.

As discussed above, all spending for defence is treated as current exogenous expense, whether for current or capital items. It is thus being assumed that military capital is not productive with respect to the civilian side of the economy, while other government capital is. This is a purely economic argument and does not mean to deny the usefulness of military capital as deterrent against aggression, and its productivity in actual military operations.

The recent historical path of growth in the stock of national capital is depicted in Chart 6:3. Here we observe the roughly parallel pattern of growth in the three components of the total stock, the low rate of growth in the 1920's, the negative growth rate, and the consequent decline in the stock of capital during the Great Depression and World War II, followed by the upsurge in this growth in the post-war.

To get a more definite picture of actual growth rates in this national stock and its components, the following summary is presented in tabular form, based on B-1-1-6.

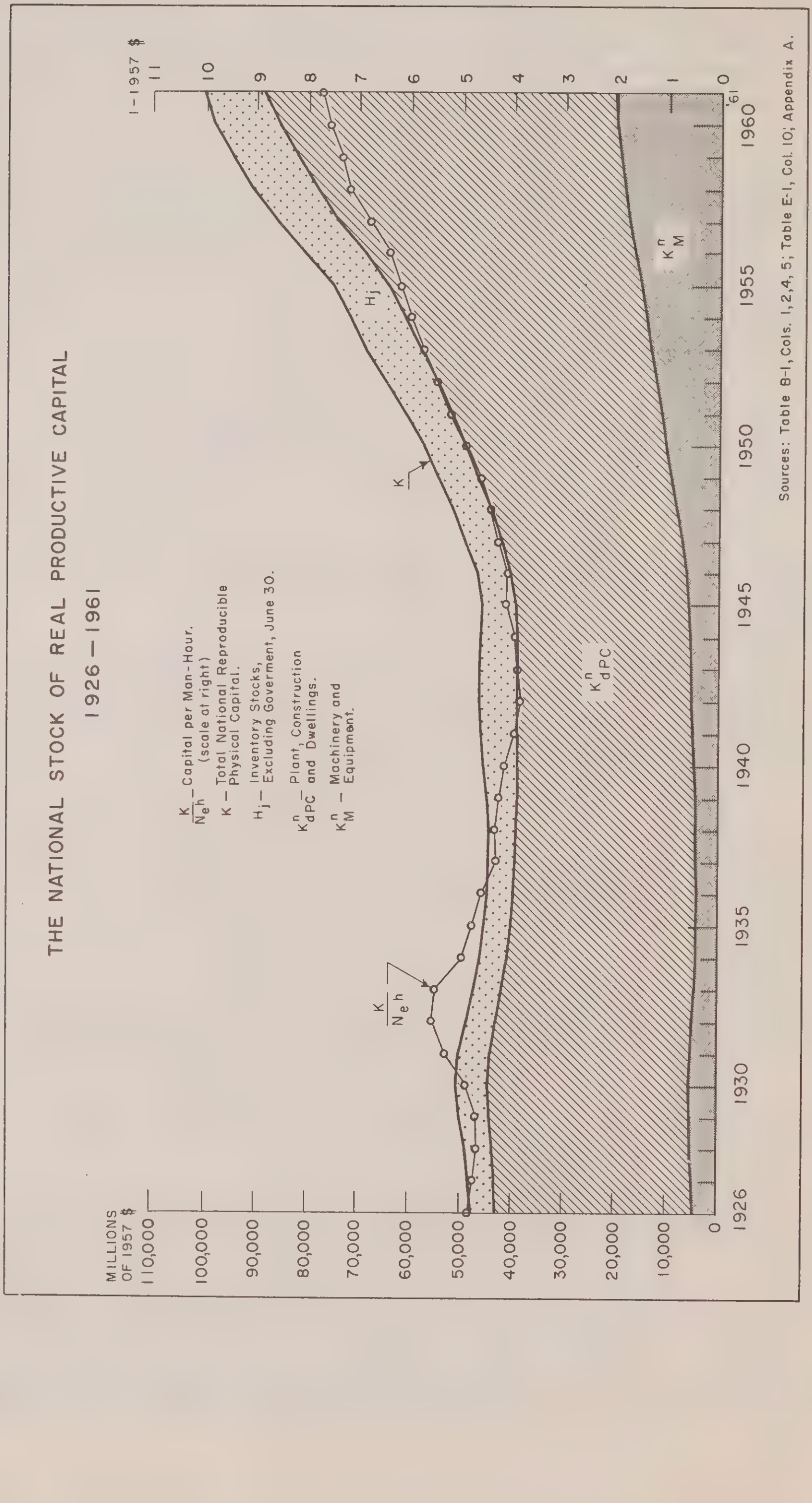


CHART-6:3
THE NATIONAL STOCK OF REAL PRODUCTIVE CAPITAL
1926 — 1961
$\frac{K}{N_e h}$ – Capital per Man-Hour. (scale at right)
K – Total National Reproducible Physical Capital.
H_j – Inventory Stocks, Excluding Goverment, June 30.
K^n_{dPC} – Plant, Construction and Dwellings.
K^n_M – Machinery and Equipment.
MILLIONS OF 1957 $
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1-1957 $
11
10
9
8
7
6
5
4
3
2
1
0
1926
1930
1935
1940
1945
1950
1955
1960
'61
$\frac{K}{N_e h}$
K
H_j
K^n_{dPC}
K^n_M
Sources: Table B-1, Cols. 1,2,4,5; Table E-1, Col. 10; Appendix A.

GROWTH RATES IN THE NATIONAL STOCK OF CAPITAL AND IN ITS COMPONENTS
(per cent)

		1926–29	1946–61	1926–61
K^n_M	Machinery and Equipment ...	5	8	4
K^n_{dPC}	Dwellings, plant and Construction	⅓	5	1¾
K^n_{dPCM}	Total Fixed Capital	¾	5½	2
H	Inventory Stocks	7	4½	3
K	Total National Stock of Capital	1½	5¼	2¼
GDP	Gross Domestic Product	6¼	3½	3½

In this table we first note the more rapid growth of the stock of machinery and equipment than that of dwellings, plant and construction. We would expect an increasingly complex technology to be reflected more in machinery and equipment than in buildings and construction. We also note, that in the long run, K^n_M is growing a little faster than GDP, K^n_{dPC} is growing slower, and H about the same. (In the period 1946–56, when the main back-log stimulus was present the growth rate of GDP was 4½ per cent). We also note that capital has grown at a much greater rate than man-hours, so that the ratio real capital per man-hour has a pronounced upward trend.

The projected growth of the stock of capital was approached in three different ways in the three projections which follow. In the first projection it is merely assumed that capital would grow at a sufficient rate to sustain a projected rate of growth in real output per man-hour. In the second projection it is assumed that K grows at the same rate as GDP, an assumption for the long run which has certain theoretical backing. The third projection is carried out with an econometric growth model of the Canadian economy. In this model, K is carried forward with three investment demand equations, plus an equation which estimates the real depreciation of fixed capital.

C. Knowledge, Technology and Social Factors (Socio-Technical Factors) — Their Influence on Growth

These are in part some of the dimensions of labour which are not directly measurable, and which were discussed in Chapter 3. They also can represent some of the dimensions of capital equipment which are conceptually present in its true value, but which may not be represented in its cost of production. Perhaps

also the accumulating body of knowledge could stand by itself as a factor of production, but it is not directly measurable.

Those factors of production which can be separately measured or estimated or man-hours of labour, fixed capital, inventory stocks, and energy. The latter two can be taken as roughly complementary with fixed capital. When the effects of man-hours ($N_e h$) and of the stock of fixed capital and inventories (K) on the growth of output have been accounted for, there is left a residual of unexplained growth. This is attributed to the combined effects of the accumulation of knowledge, technological discoveries, and economic development; improvements in management science and skills, improvements in the skills and health of workers; and changes in the attitudes and morale of the work force in general. This residual complex of forces and influences can be estimated. It is the factor A to which we have given the abbreviated designation of "technical progress" in our production relationship, explained in earlier chapters. A and its growth rates are shown in E–2–12 and E–2–13. It has a long-term growth rate of 1.7 per cent. It has a tendency to decline when the economy slows down or goes into the downswing of a depression, probably reflecting a malproportion of labour to capital, combined with changed human emotions and attitudes at such times. A was projected with growth rate 1.7 per cent (PR–2:$^{\circ}A_5$).

D. Volume of Output

We have analysed growth in the factors which produce output – labour, capital, and socio-technical change. We saw labour input (man-hours) displaying a long-term growth rate of ¾ per cent, capital experiencing a long-term growth rate of 2¼ per cent, and technical progress with a growth rate of 1.7 per cent. It is the combination of these inputs in an aggregative technological relationship or production function which explains growth in total output. The long-run growth rate in the volume of output or value added by the civilian sector was 3½ per cent (GDP_c: F–1–5). If we combine the above input growth rates into growth formula (15) of Chapter 3, assuming average factor shares of $y_L = .53$, $y_K = .47$ (E–2–5,6), we get $^{\circ}O = 3.2$ per cent.

To see the effect of this growth in production on the real income or production accruing to Canadians we next tabulate growth rates in real GNP for selected periods (C–1–11).

Period	*Growth Rates of Real GNP*
1926–47	3½%
1947–56	5
1947–51	3¾
1926–61	3½

The long-term rate observed reflects neither the optimal nor the ceiling growth rate for Canada. For it is a resultant of steady growth, negative "growth" in the downswing of depression, positive "growth" in the upswing, and fluctuations caused by both minor causes and major episodes. World War II and the Korean War are the main examples of the latter.

Impressions about the optimal growth rate (free social choices at high employment) can be gained from observing growth in years when the economy was at high employment, and was not just climbing out of unemployment. The data for such years is presented in the following table.

Year	$°GDP_c$	$N_u°$
1927	8.9%	2.9%
1928	9.3[1]	2.3
1929	.9	2.4
1945	-1.4	1.6
1947	3.5	2.4
1948	1.5	2.5
1951	5.2	2.7
1952	7.2	2.9
1953	3.7	3.0
1956	8.8	3.4
Average	4.8	2.6

On the basis of this empirical evidence we can assume that an optimal growth rate for Canada is of the order of 5 per cent. In fact we get confirmation of this order of magnitude from the econometric projection in Chapter 10, once the high employment growth path is attained. The significance of this rate can be appreciated from the fact that with a 2 per cent population growth rate it implies a potential doubling of the Canadian standard of living every 25 years.

Evidence of a ceiling growth rate for Canada is available for only one year. This is 1942 when at full employment, GDP_c grew 16½ per cent. This was a year of exceptionally bountiful crops. An estimate by the author of private sector, non-agricultural, growth for that year is 14½ per cent, which is still very high.

On Chart 6:4 we present a composite picture of growth in output, and growth in the factors of production.

E. Average Productivity Ratios

When the physical volume of output is divided by the quantity of input of a factor of production the result is an average productivity ratio. This ratio does not attribute the productivity to the factor selected. In fact, gains in this productivity ratio may be due to increases in the quantity of input of some other factor, or to qualitative improvements in other factors, or to socio-technological improvements in general. But some or all of the gains may be due to the factor in question. It all depends upon the particular circumstances of any individual year or case, and these can only be appraised from the relevant chronology of events and current economic history.

[1] The years 1928 and 1942 were years of exceptional crops in Canada.

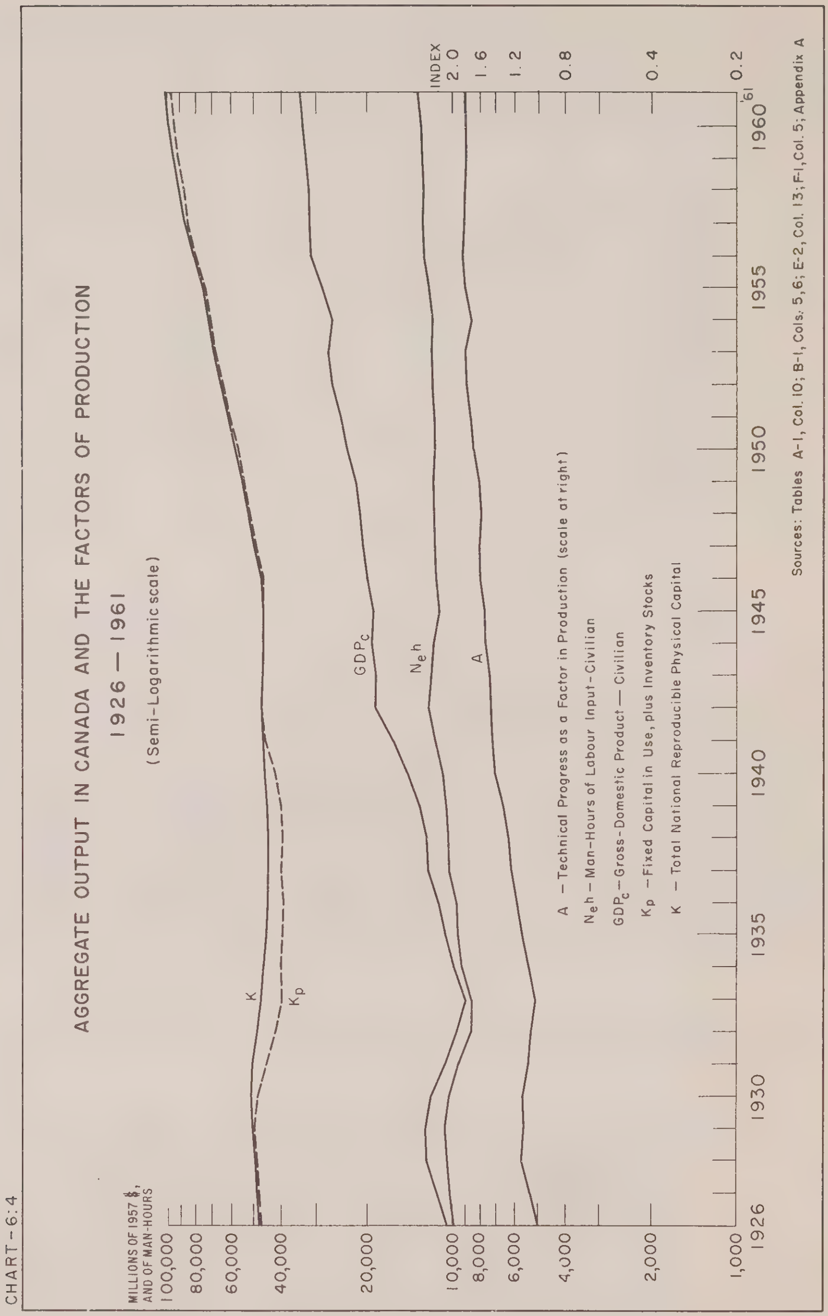


CHART-6:4
AGGREGATE OUTPUT IN CANADA AND THE FACTORS OF PRODUCTION
1926 — 1961
(Semi-Logarithmic scale)
MILLIONS OF 1957 $, AND OF MAN-HOURS
100,000
80,000
60,000
40,000
20,000
10,000
8,000
6,000
4,000
2,000
1,000
INDEX
2.0
1.6
1.2
0.8
0.4
0.2
1926
1930
1935
1940
1945
1950
1955
1960
'61
K
Kp
GDPc
Neh
A
A – Technical Progress as a Factor in Production (scale at right)
Neh – Man-Hours of Labour Input-Civilian
GDPc – Gross-Domestic Product — Civilian
Kp – Fixed Capital in Use, plus Inventory Stocks
K – Total National Reproducible Physical Capital
Sources: Tables A-1, Col. 10; B-1, Cols. 5,6; E-2, Col. 13; F-1, Col. 5; Appendix A

In this growth study average productivities relative to labour (p_L) and to capital (p_K) have been estimated (E-1-2,11). They are also referred to as real output per man-hour, and real output per constant dollar of capital input. In order for the economy to develop and the standard of living to grow, the average productivity relative to labour must increase. This is both a symptom and a measure of growth (cf. Chap.3). Average productivity relative to labour (p_L) has grown at long-term rate (1926–61) of 2¾ per cent. The corresponding productivity relative to capital, (p_K)[1], has also grown, though at a slower rate, 1¼ per cent per annum.

In our theory, and in the econometric production function presented in Chapter 9, the socio-technological growth factor A is also a measure of *total productivity* (p_T). It thus represents the extent to which the *production function* of labour and capital alone *lifts* under the influence of social and technical improvements. As mentioned above $A = p_T$ has a long-term growth trend of 1.7 per cent.

p_L is an especially important productivity and growth measure, for it represents the current average rate of exchange between an hour of labour and the goods obtainable from this hour. Society must balance the net utility obtained from this hour of labour against the utility to it of an additional hour of leisure. The higher is p_L, the higher can be both the material standard of living, and the amount of leisure chosen.

The trends in the three measures of productivity change in the total Canadian economy (civilian) as estimated in this study are found in Chart 6:5. If we construe p_L as that measure of productivity which is of the greatest ultimate significance to welfare, and the ultimate measure of growth, then the other ratios on Chart 6:5 can be construed as explanatory measures related to p_L. Thus K/N_eh, the available capital per man-hour of labour input, is one of the main explanations of the growth in p_L. This ratio has had a long-range growth rate of 1⅓ per cent (E–1–10). If this change in capital per man-hour were the sole explanation of increases in average output per man-hour, we could have $p_L = a \dfrac{K}{N_eh}$, $\dfrac{O}{N_eh} = a\dfrac{K}{N_eh}$, and $\dfrac{O}{K} = a = p_K$ would be a constant. In fact, as observed above, p_K has grown at the rate of 1¼ per cent, while p_L has grown at the rate of 2¾ per cent. The reason why p_L has grown faster than K/N_eh, and why p_K has not remained constant can be found in the technical progress variable $A = p_T$. Improvements in knowledge, skills and technology explain why output per man-hour has grown faster than capital per man-hour, and why p_K, which should remain constant on the basis of the acceleration principle, has in fact, also grown.[2] These are purely empirical findings, and are not based on any *a priori* reasoning.

[1] For this part of the analysis it would have been better to have estimated p_K, as GDP_c/K rather than as GDP/K, to have closer comparability with p_L. Had this measure been used, p_K would have changed only very little, except in the war years, and its long-term growth rate would still have been 1¼ per cent.

[2] Let $GDP_c = O = A\,(a_1L + a_2K)$.
$O/L = p_L = A\,(a_1 + a_2\,K/L)$. ${}^{\bullet}p_L = {}^{\bullet}A + y_K\,{}^{\bullet}(K/L)$. Using the data of Appendix A, we find that historically ${}^{\bullet}p_L$ = 2¾ per cent, ${}^{\bullet}A$ = 1.7 per cent, $y_K \doteq .47$, ${}^{\bullet}(K/L)$ = 1⅓ per cent. ${}^{\bullet}A + y_K\,{}^{\bullet}(K/L) = .023$. The discrepancy is partly due to using a differential formula for finite one year time periods, and an average value for y_K. But the results are close enough to show that ${}^{\bullet}A$ overshadows ${}^{\bullet}(K/L)$ as the main cause of ${}^{\bullet}p_L$. A similar analysis reveals that it is ${}^{\bullet}A$ which gives $p_K = 1/k$ its upward trend. But for ${}^{\bullet}A$, p_K would decline with the fall in L/K, and hence k would rise. ${}^{\bullet}A$ appears to be behind the historical fall in k.

The *a priori* causal explanation of $\dot{p}_L$ is of course in terms of $\dot{A}$ and $\dot{(K/L)}$, but does not specify the size of y_K. The post-war experience in these matters is revealed by Chart 6:5 indicating that it differs from the long-term trend. In the post-war K/L grows faster than p_L, $\dot{A}$ slows down, and p_K experiences a fairly steady decline.

The time path of these productivity ratios reveals a cyclical pattern and the impact of exogenous episodes, as well as the long-term growth trends discussed. We note that p_L tends to fall with the downswing of depression, presumably because administrative and maintenance staff cannot be reduced as rapidly as output falls, while direct labour as a rule can be laid off fairly readily. A further cause of the decline in p_L may be that production functions are nonlinear so that there are optimal levels of output, for productivity, presumably when plants are being used at full capacity. At this level of use the proportion of labour to capital should be at the optimum as designed by the engineers.

A further cause of low productivity in depression relates to socio-technological improvement. We cannot expect education and research to progress at the same pace in depression as in prosperity. Nor can we expect innovations to be pursued as vigorously in depression as at other times for reasons of low finances and reduced demand. Nor can we expect workers to have high morale and a proper attitude toward work and productivity when there is widespread unemployment. We observe that the socio-technological factor A declines in periods of depression and unemployment. Presumably this happens for the above reasons, and possibly also because the effects of nonlinearities in production functions are reflected in the term A.

There is clearly a productivity bonus to society for full employment operations, a bonus which may itself pay the 'costs' of full employment policies.

Having looked at the historical record of productivity, let us next look briefly at how Canada has used her productivity gains. This is depicted in Chart 6:6. This chart is built up from per capita data followed by adjusting total per capita GNE to what it would have been if hours of work and the rate of employment (unemployment) had remained constant at their 1926 values. The result is called 'Potential Output' per capita (gne_p) and its movements are closely similar to those of p_L. This is because

$$(3)\quad p_L = \frac{GDP_c}{N_e h} = \frac{GDP_c}{(Npr_1 - N_M)\ er\ .h}; \quad gne_p = \frac{GNE}{N} \cdot \frac{h_{26}}{h} \cdot \frac{er_{26}}{er}.$$

The most striking trend in this chart is the pronounced growth in leisure; coupled with the growth in national consumption per capita. Only a strong productivity trend could achieve this dual form of economic welfare. At the same time we can be dismayed at the losses or gaps which this chart reveals in our material welfare and standard of living during the years of depression and a large volume of unemployment. We note how national saving almost vanished in 1933, with 1928 revealing its free potential for that period. We note also how our saving has dropped below this same free potential in 1954, and in recent years. In each case this has been due to a failure of national investment to match free, high employment savings.

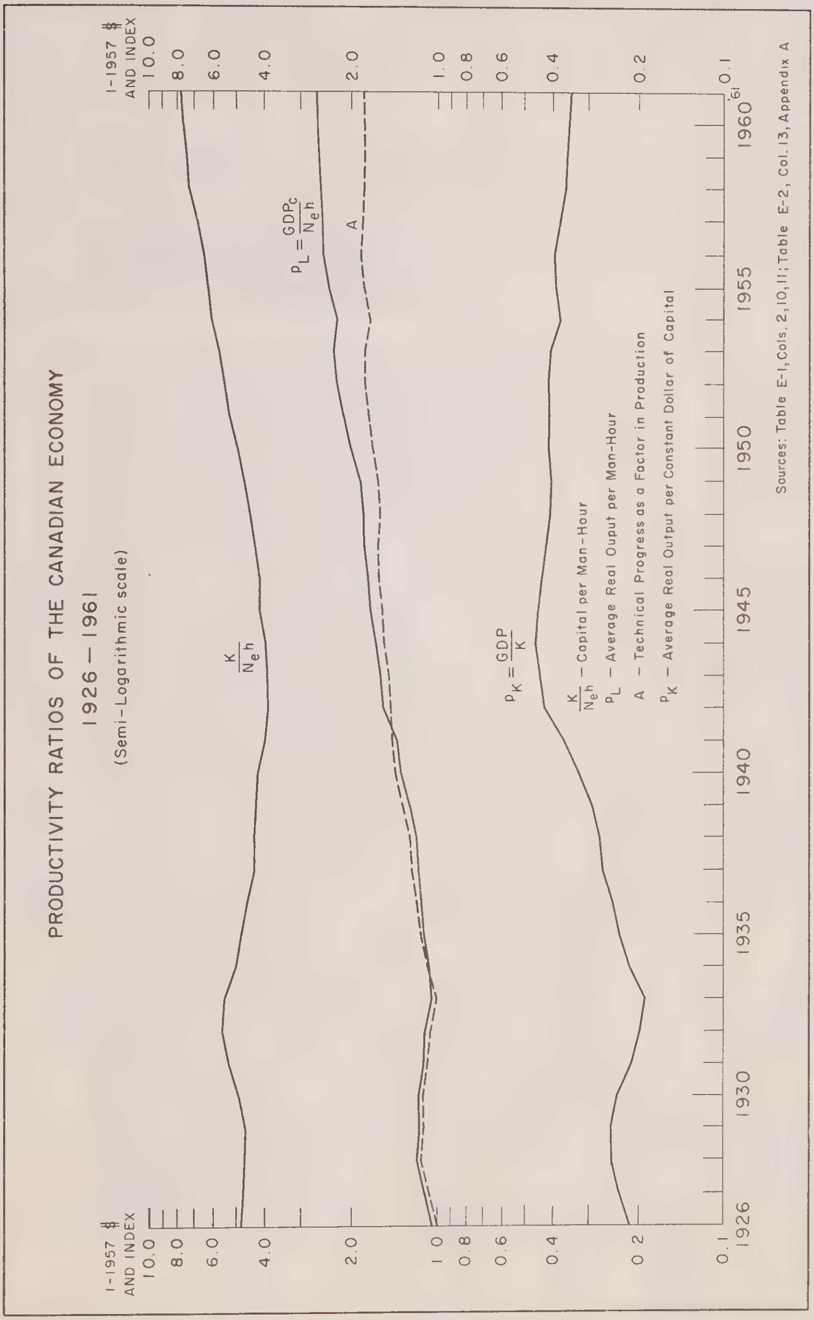


CHART-6:5
PRODUCTIVITY RATIOS OF THE CANADIAN ECONOMY
1926 — 1961
(Semi-Logarithmic scale)
1-1957 $ AND INDEX
10.0
8.0
6.0
4.0
2.0
1.0
0.8
0.6
0.4
0.2
0.1
1926
1930
1935
1940
1945
1950
1955
1960
'61
$\frac{K}{N_e h}$
$P_L = \frac{GDP_c}{N_e h}$
A
$P_K = \frac{GDP}{K}$
$\frac{K}{N_e h}$ – Capital per Man-Hour
P_L – Average Real Ouput per Man-Hour
A – Technical Progress as a Factor in Production
P_K – Average Real Output per Constant Dollar of Capital
Sources: Table E-1, Cols. 2, 10, 11; Table E-2, Col. 13, Appendix A

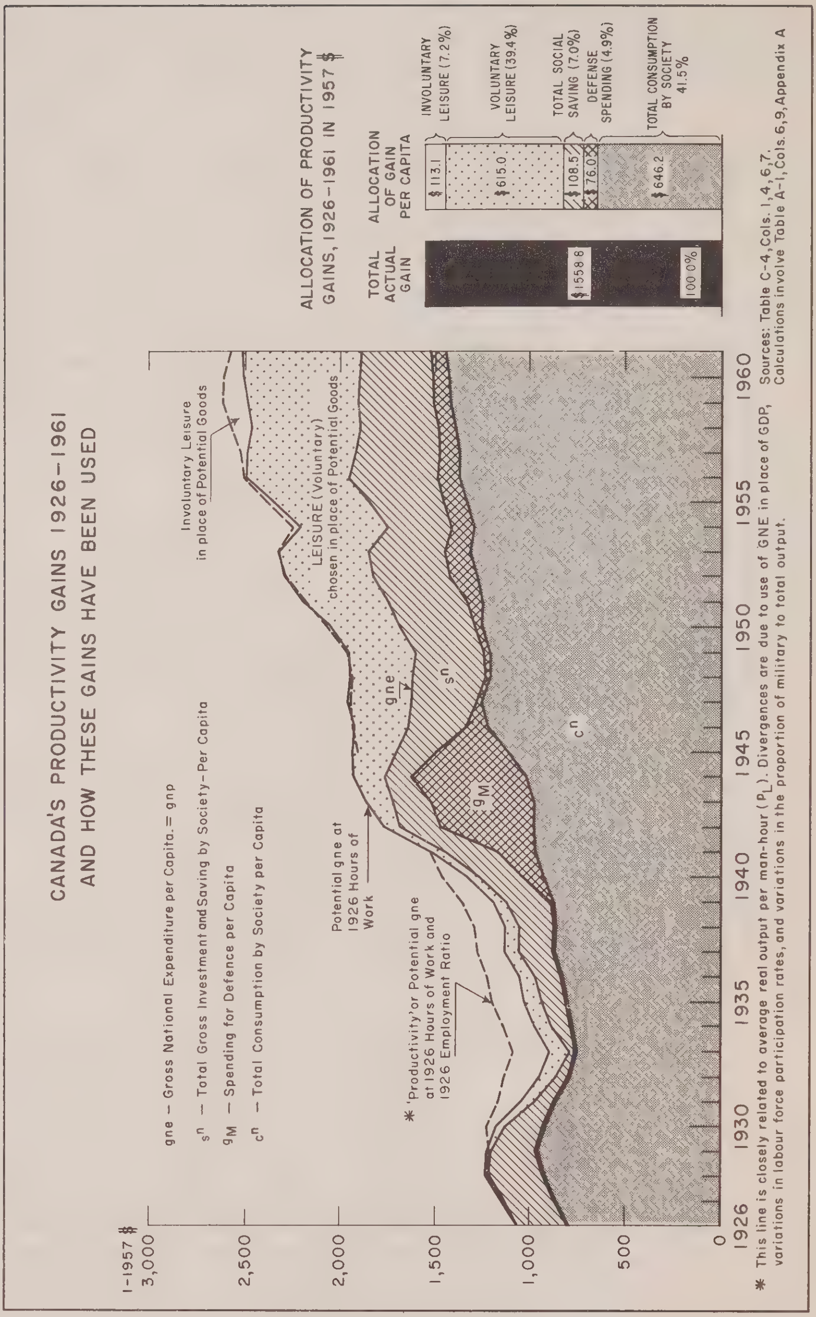


CHART-6:6
CANADA'S PRODUCTIVITY GAINS 1926–1961
AND HOW THESE GAINS HAVE BEEN USED
1-1957 $
3,000
2,500
2,000
1,500
1,000
500
0
1926
1930
1935
1940
1945
1950
1955
1960
gne – Gross National Expenditure per Capita. = gnp
s^n – Total Gross Investment and Saving by Society–Per Capita
g_M – Spending for Defence per Capita
c^n – Total Consumption by Society per Capita
* 'Productivity' or Potential gne at 1926 Hours of Work and 1926 Employment Ratio
Potential gne at 1926 Hours of Work
Involuntary Leisure in place of Potential Goods
LEISURE (Voluntary) chosen in place of Potential Goods
gne
s^n
g_M
c^n
ALLOCATION OF PRODUCTIVITY GAINS, 1926–1961 IN 1957 $
TOTAL ACTUAL GAIN
ALLOCATION OF GAIN PER CAPITA
$1558.8
100.0%
$113.1
$615.0
$108.5
$76.0
$646.2
INVOLUNTARY LEISURE (7.2%)
VOLUNTARY LEISURE (39.4%)
TOTAL SOCIAL SAVING (7.0%)
DEFENSE SPENDING (4.9%)
TOTAL CONSUMPTION BY SOCIETY 41.5%
* This line is closely related to average real output per man-hour (P_L). Divergences are due to use of GNE in place of GDP, variations in labour force participation rates, and variations in the proportion of military to total output.
Sources: Table C-4, Cols. 1, 4, 6, 7. Calculations involve Table A-1, Cols. 6, 9, Appendix A

As indicated in our theoretical discussion in Chapters 3 and 4, these failure periods could have been prevented by government policies which either reduced national saving or increased national investment. The type of policies would depend on whether national aspirations required a low or a high growth rate.

F. Allocation of Output

So far we have studied the trends in the quantities of resources or factors of production, the volume of production, the productivity relations between resources and the volume of output, and the broad trends in the uses to which our productivity gains (development-growth or vertical growth) have been used. Let us now look a little closer at the pattern of the uses to which our production has been put – the allocation of output into different categories.

The broadest allocation of output is between consuming and saving – investing. We recall that saving is done mainly for the purpose of securing future consumption, while investment has as its objective the increase of future production. All private and public expenditures fit into these two broad social categories, with government conceived of as part of and as servant to the whole society. Foreign trade likewise fits into these categories when treated as a net flow; for a positive net balance on current account represents Canadian investment abroad, and conversely.

The broad social choices are then between *leisure* and *output*, and within output, between *consuming* and *investing*. These choices are made basically on economic and social grounds – maximizing social utility using given and limited resources which have alternative uses. The resources put to work can be switched to producing whatever kinds of final goods our society decides it wants, subject only to the ingenuity of our technology.

There is one form of total consumption which it is appropriate to separate out, since, though necessary for preserving our way of life it does not add to our material standard of living. This is *defence* or *military* spending by government (G_M). As discussed above G_M (which is equal to value added by the armed forces plus purchases for defence purposes from the civilian sector of the economy) is a form of exogenous national consumption.

How have Canadians allocated their resources to these categories of final demand in the past? We find the detail on this in C–2. A few selected years are summarized here, with allocations as percentages of GNE in 1957 constant dollars.

CANADIAN ALLOCATION OF TOTAL OUTPUT (GNE)

Year	National Consumption C^{no}	Defence $G_M{}^o$	National Savings and Investment S^{no}
1926	75 per cent	½ per cent	24½ per cent
1933	94½	½	5
1947	76½	1½	22
1948	74	1½	24½
1950	74	2½	23½
1956	70	6	24
1961	76½	4[1]	19½

[1] The ratio has fallen below 4 per cent in 1964.

It was necessary to project the pattern of allocation of GNE for Projections 1 and 2. It will be recalled that our assumptions were that we would remain near full employment from 1966 on, and that there would be no major war. It is evident that in the past there has been a tendency for us to save 24 per cent of GNP and consume 76 per cent on national consumption and defence when at high employment and not in major war. For Projections 1 and 2, however, it was decided to assume a national savings percentage of only 21 per cent, at 4 per cent unemployment. The reasoning behind this assumption was that, although our natural desired rate of saving might still be 24 per cent or more, as we become a richer and more mature economy, our investment opportunities may fall to 21 per cent, barring major innovations. To maintain high level employment under these conditions government policy would have to reduce desired national saving $S^{n\circ}$ to 21 per cent. While this would involve adjustment of taxes and transfer payments, it could be assisted very much by government promotion of expanded health services. The increased hospital space and equipment would lift the investment side of the equation, while the expanded services would raise national consumption and reduce the savings side of the equation. Our assumption leaves 79 per cent for civilian and military consumption. It was assumed that we would remain at 4 per cent on defence consumption as in 1961. This leaves 75 per cent for national consumption. This would put us on something below a high growth path, but may present an easier basis for both high employment policy and more immediate expansion of foreign aid.

If however, it became a national policy to pursue a high growth path, which would permit higher consumption and foreign aid in the *future*, government could devise a program of fiscal, monetary and other economic policies to nudge the economy to 25 per cent saving, 4 per cent defence, and 71 per cent for civilian consumption.

Public Consumption, C_g

This part of national consumption includes all government expenditures on goods and services, but excludes public capital formation and military and defence spending. It thus represents the cost of providing all of the *services* which we as a society consume collectively. We suggested in Chapter 4, that it should only include those areas of public administration and regulation which only government can do, or those areas where there are extensive external economies to private production or consumption, such as the expansion of education and health services.

As the society and the economy develops and becomes more complex, it can be assumed that the proportional allocation to public consumption will increase to a higher ratio. Let us examine its proportion of GNP, in the past, and the trend in its growth rates. (C-5-9).

Year	Public Consumption as Percentage of GNE: C_g°
1926	7¾ per cent
1946	5½
1947	7½
1956	8½
1961	10

Period	Growth Rates of Public Consumption: $\dot{C}_g \times 100$
1926–39	$2\frac{1}{4}$ per cent
1926–46	2
1946–56	9
1956–61	$5\frac{1}{2}$
1946–61	8
1926–61	$4\frac{1}{2}$

On the basis of these tables and graphical analysis, C_g° was projected to rise gently to 13 per cent of GNP in 1991.

Private Consumption C

The picture that has been presented of the allocation of GNP to civilian and to public consumption, implies within it the allocation to private consumption, for $C^n = C + C_g$. This allocation is set out in the following tables. (C–1–1).

Year	Private Consumption as Percentage of GNE: C°
1926	67 per cent
1933	$84\frac{1}{2}$
1947	69
1956	62
1961	$66\frac{1}{2}$

Period	Growth Rates of Private Consumption: $\dot{C} \times 100$
1926–39	2 per cent
1939–45	$6\frac{1}{4}$
1926–46	$3\frac{1}{2}$
1946–61	$3\frac{1}{2}$
1926–61	$3\frac{1}{2}$

We see from these tables that the rate of growth of private consumption was stimulated by the war, and has stayed at the higher rate in the post-war. The post-war rate has of course been augmented by the increased pace of population growth.

Private and public consumption grew at about the same rates pre-war, but public consumption has quickened dramatically, ahead of private, in the post-war.

Private consumption itself is allocated into a multitude of forms, but it is useful to consider a broad, three-way, grouping into *non-durable* goods, *durable* goods and *services* (cf. C–5 and C–6). The trends in the proportional allocation in these groups are disturbed by depression and war. However, in the post-war period we find a clear downward trend in the proportion allocated to non-durables, and an upward trend in the proportions allocated to durables and to services. These trends were projected graphically.

The service group includes that part of the health services which is demanded and paid for by private consumers. This expenditure has been a fairly constant proportion of total private consumer spending varying from 4½ per cent in the late 1920's to 3½ per cent in 1955. Since then it has started to climb (C-6-4), reaching 5½ per cent in 1961. The *total* national health services of course include much more than this component, and are analysed in detail in the study prepared by Dr. J.J. Madden for the Royal Commission on Health Services.[1]

National Consumption of Services

If we combine private spending on services C_s, with public consumption, C_g, the latter representing the services provided by government, we obtain a rough measure of national consumption of services C_s^n (C-5-10). There is only a rough correspondence between this aggregate and the concept of service employment. The former is a classification of final output, representing value created when factors of production perform an act or function for people, as distinct from producing a material physical good for them. Service employment on the other hand is an occupational classification, and the work performed in this occupation may assist in the production of material goods or of final services. One lawyer (or doctor) may act for an automobile company, while another may act only for households. Also it should be noted that C_s^n includes the services of housing in house rents paid and imputed. There is still however, sufficient overlap between the two concepts to make comparison of interest.

C_s^n was 36 per cent of GNP in 1926, 28½ per cent in 1946, 27½ per cent in 1947, 30½ per cent in 1956 and 34½ per cent in 1961. There is a definite upward trend in the postwar period, corresponding roughly to the employment trend noted earlier in this chapter.

More research is needed to explain the high proportion of services in the late 1920's. One possible explanation may be that consumer durables had not yet come into their own, leaving more room for services. This is the story suggested by C-6. In any event the postwar trend was taken into account in Projection No. 2 in which the national consumption of services reaches 38½ per cent of GNP by 1991.

Private and Public Investment Trends

The proportions of private and public real investment (C-1-6,7; C-1-12) to real GNP are tabulated for selected years in the following table.

REAL INVESTMENT ($GI + GI_d + \Delta H$) AS PERCENTAGE OF GNE

Year	Private	Public
1926	17½ per cent	2¼ per cent
1927	21	2½
1951	22½	2¾
1956	25½	3½
1961	16½	4¾

[1] Madden, J.J., *The Economics of Health*, a study prepared for the Royal Commission on Health Services, Ottawa: Queen's Printer.

Here we see both private and public investment slowly becoming an increasingly large proportion of GNP, but the trend in the public is more steady and less affected by capital outflows and inflows, or by the business cycle.

Looking at growth trends we get the following picture.

GROWTH RATES OF REAL INVESTMENT ($GI+GI_d+\Delta H$)

Period	Private	Public
1926–47	4 per cent	4¼ per cent
1947–61	2¾	8¼
1926–61	3½	6

From these growth rates we observe that public investment, following public consumption, began to accelerate in the postwar period. This is in keeping with the general postwar trend. Private investment on the other hand has lagged in the latter part of the post-war period.

Government Expenditure on Goods and Services, G.

In this category we group all public expenditure for consumption, investment and defence ($G = C_g + GI_g + G_M$). The proportion of public use of total final production or income is shown for selected years in the following table (Ref. C-1-2). G is the familiar National Accounts category, Government Expenditure on Goods and Services.

Years	Govt. Expenditures as Percentage of GNP	
	Excluding Defence	Including Defence
1926	10 per cent	10½ per cent
1933	12½	13
1944	5½	40
1946	8	14¾
1947	10	12
1956	12	18
1961	15	19

We note that the total proportion including defence has nearly doubled in the 35 years of our observations. But when defence costs are excluded the proportion by 1961 has only increased to 1½ times its 1926 proportion. We also note that the expansion in the civilian proportion began only in the post-war period.

Let us next look at the growth rates of the government sector.

GROWTH RATES OF GOVERNMENT EXPENDITURE

Period	Defence and Military Expenditure G_M	Civilian Expenditure Excluding Defence	Total Expenditure Including Defence G
1926–38	7½%	2¾%	3%
1926–47	12	3½	4¼
1947–61	10½	6½	7½
1926–61	11¼	4¾	5½

These tables on government expenditure depict in statistical form the trends we have already discussed in regard to the public sector. We observe that in the prewar period government grew at about the same pace as the private economy. It is in the post-war with the increasing complexity of social affairs both internally and internationally that government has had to assume ever greater responsibilities. Defence in particular has had an especially strong impact on the growth rate of government spending.

Foreign Trade and Finance

We begin by looking at the pattern of the components of the Current Account Balance (C-1-8,9; C-2-3,9), as percentages of GNP.

Year	Exports of Goods and Services	Current Account Balance Percentage of GNP in 1957$	
		Imports of Goods and Services	Current Account Balance or Capital Flow
1926	28.1%	-26.5%	1.6%
1947	26.8	-27.0	-0.2
1956	20.1	-25.1	-5.0
1961	21.3	-23.4	-2.1

Here we observe the decline in relative importance of our export trade, and the rather large capital inflows which began in 1950.

We next look at the growth rates of these components of foreign trade.

GROWTH RATES OF FOREIGN TRADE IN 1957$

Period	Exports of Goods and Services	Imports of Goods and Services
1926–47	3¼%	3½%
1947–61	2¼	2¾
1926–61	2¾	3¼

The capital inflow of the last 11 years of our observations, and the above differential growth rates in our foreign trade can be attributed to two main causes. One is a failure of Canadian manufactured goods to be sufficiently competitive in price and quality with foreign goods. Part of our unemployment problem lies here. The second is the recent development of Canada's resource industries by foreign capital. Capital goods from abroad have followed the inflow of finance capital, especially that for direct investment; then both capital and consumer goods flowed in under the inducement of rising incomes and the high exchange value of the Canadian dollar. The exchange reserves were held fairly constant.

G. Standard of Living

The economist is ultimately concerned with the economic welfare of society, and with the forces which determine this. Economic welfare might be considered very roughly to be a function of the income distribution, average real consumption per capita (assuming reasonable consumer choice), the amount of voluntary leisure, and the rate of unemployment. In this study we can only consider the last three of these components. Leisure, and unemployment have already been discussed. We now look at real national consumption per capita ($C^n/N = c^n$: C-4-1), and suggest that it can be used as an approximate measure of the Canadian standard or level of living, and of changes in this level. This variable includes our giving of foreign aid.[1]

In the period from 1926 to 1961 total national consumption (C-2-1) increased to 3½ times its 1926 level. In the same period population (A-1-1) nearly doubled. As a result the standard of living c^n went from \$798.3 (1957\$) per capita to \$1,444.5 (1957\$) per capita, thereby going up by a factor of 1.8 times its 1926 value. It thus nearly doubled in the 35 years of our historical data. The growth rate of standard of living over this period is 1¾ per cent. This is not as high as the growth rate of real output per man-hour, 2¾ per cent,[2] to which it is of course closely related, because of the growth in leisure, unemployment and defence expenditures.

In the projections which follow it develops that we Canadians can, on the basis of reasonable assumptions, double our already high standard of living in the next thirty years. This includes increasing our use of leisure. This is a remarkable feat, but we can do it if we will manage our economic affairs appropriately.

---

[1] An alternative would be to take foreign aid out of public consumption, and treat it as another exogenous variable.

[2] See page 93 ff.

CHAPTER 7

PROJECTION NUMBER ONE

In earlier chapters we discussed the theory of economic development and economic growth. Then in the preceding chapter we surveyed the recent economic growth of Canada. All this was leading up to and preparing the way for the projection of Canadian growth into the future. In this chapter we present the first of the projections of our study. In all there will be three projections, each made with the help of a model of the economy. The three models are of increasing order of complexity or sophistication, each reflecting more detail of the behaviour of the economy.

1. The Meaning and Nature of Projection

A projection is not a forecast in the sense that we expect what is projected to actually happen. It is rather an extrapolation of the systematic, long-term *trends* which have been observed in the economy in the past. But the structure of an economy is such that it produces more than long-term trends. It also produces *cycles* about the trends, and in addition is subject to many *random* influences which cause it to fluctuate irregularly. Most of the random influences are small, and arise from a myriad of irregular acts of non-systematic behaviour or disturbances in the economic system, which are added to the systematic behaviour of individuals and of the aggregate system. Some, however, are large influences arising from some major international event, natural phenomenon, scientific discovery, or social upheaval. These are classed as *episodes*. Their effects show up distinctly as large irregularities in economic time series.

Clearly an extrapolation of long-term trends will not allow for the inevitable cycles, random perturbations and major episodes which can be expected in the future. But it would be impossible to allow for these in any event. Only the cycle could perhaps be forecast for a little while into the future, but even it will be subject to whatever government policy is aimed at its control. Thus about the only kind of economic movement that one can hope to project for any considerable period into the future is that of the long-term trends of the economy. The result will be smooth and stately movements, not at all like the economic series of everyday life which have the cycles and the irregularities superimposed upon them.

But even the trends which we project may turn out to be wrong, for these trends are produced by the underlying behaviour patterns and technological relationships of the economy; and these are likely to evolve slowly in such a way as to alter the long-term trends of the economy. To be more specific about the kinds of forces which may alter the longer term relationships in the growth of the Canadian economy, we can mention the following. In the first place the fact that Canada is an open economy means that her future prospects depend very much on developments in the pattern of world demand for the goods which Canada can produce in surplus with comparative advantage. Related to this pattern of demand is of course the terms of trade for Canadian exports versus imports. Canada's real income and future growth will depend on this imponderable, linked with the state of the future world demand.

The structural problems, discussed very briefly in Chapters 4 and 5, will also have a considerable bearing on the trends of our future growth. To the extent that we are able to solve these problems we shall tend to have higher growth trends and conversely. One of these structural problems is especially related to our vulnerability as an open economy. This relates to our ability to maintain a competitive position in the world markets, not only with our primary products, but also in areas of secondary and tertiary production in which we decide to specialize. The more we are able to achieve excellence, at competitive prices, the less we need fear the vagaries of the world pattern of demand mentioned above.

In the projections which follow we have had to make an assumption about the future downward trend in the average hours of work of the Canadian people. The assumption for the projection of this important variable was of course based on the past trends, over-all and post-war. But many forces, sociological as well as economic, may alter our future choices between work and leisure. We can expect the outcome to differ from our assumption, but we have no way of knowing whether the outcome will be above or below, or by how much.

A similar uncertainty underlies all of our projections of technical progress. Who can foresee the great discoveries in science, the ingenious inventions, the changes in human spirit and morale which are yet to come. And those that do come will set in train completely new trends in our technical progress, and hence in our real output per man-hour, and per constant dollar of capital — our average productivities relative to labour and to capital.

Since economic projection is beset by so many difficulties and uncertainties, it may be wondered what value there is in conducting such an exercise. The value lies in the fact that the projection may be reasonably accurate for the early part of the period projected, and hence can serve as a basis for action in guiding the economy toward social and economic goals for this period.

To look further at this matter, we observe that every individual in his daily round of life must make decisions and act, on the basis of the best estimate he can make of the future. This is necessary for his survival and progress. A whole society must do the same. There is really no question about whether a soci-

ety should make use of forecasts and projections. It does use them, consciously or unconsciously, every day of its existence, as a basis for its myriad of small and large decisions. The only question at stake is *how explicitly and carefully* the forecasts and projections are to be made.

A carefully and more or less scientifically prepared projection is likely to serve better than mere intuition or trial and error to help the society make better decisions, on the average, for setting its immediate course toward its long-term goals. But then since there is a likelihood that the trends may change, the projection must be kept under continuous review and revision, so that plans and decisions for the future can be revised at intervals.

Such a process of indirect economic control through projection and planning can be likened to the navigation of a ship or aircraft to a distant destination. The goal is known in advance, and a course is calculated and set for it, based on conditions in the atmosphere and in the craft as best they can be ascertained at the time. But these conditions are under continuous review as the journey proceeds. Then as changes in this environment, or in the craft's structural characteristics are detected, the course is altered accordingly. This process is successively repeated, until the destination is finally reached.

A systematic procedure like this, based on calculations using the best data and theory, is far more likely to achieve success than the sole use of intuition and trial and error – in economic navigation, as in marine and air navigation.

2. The Model Used for Projection No. 1

In this projection a very simple model is used. The lead variable is population N which is projected independently, on the basis of trends in fertility rates, mortality rates and net migration. (see Appendix E). This population is then separated into male and female, age 14 and over, non-institutional and civilian. This is the sector of the population from which the civilian labour force can come. To the total male and female groups projected male and female participation rates pr_m and pr_f are applied. This produces for us the projected civilian labour force N_{1-M}. To this we apply the projected employment rate er, arriving at the number employed N_e. Then the hours of work h are projected, enabling us to project man-hours of labour input N_eh.

We may now express the supply potential of the economy as (1) $O = A(a_1N_eh + a_2K)$. Here we assume the simple linear production function, subject to lifting by socio-technological change A. The simplest relationship between output and labour input is given by the average productivity relative to labour.

(2) $\dfrac{O}{N_eh} = P_L = A(a_1 + a_2 \dfrac{K}{N_eh})$. This simple formula analyses productivity as a function of technical progress and the ratio of capital to labour input.

If p_L appears to have a long-term growth trend in the past we may project this trend into the future. With p_L and $N_e h$ projected we can then compute projected O, as implied by (2) above. This projection of O will represent a *potential output or supply*. It will in fact only occur if there is sufficient *demand* to call it into being.

In effect we assumed or projected a particular trend of demand when we assumed the employment ratio er. For, given the conditions of supply, the demand which actually ensues will determine the employment ratio.

The allocation of total output to different categories of final use can then be projected on the basis of past trends and analysis with respect to this allocation.

Such is the structure of the model used for making Projection No. 1.

3. Basic Assumptions and Results of Projection No. 1

In this section we discuss the basic assumptions for this projection. The projected numerical results of these assumptions, both direct and more removed, are tabulated as an appendix at the back of this chapter, labelled as Projection No. 1. We refer to this table as PR–1. We can now begin with an over-all general assumption, that during the 30 years of the projection we shall experience no major war or catastrophe. More specific and detailed assumptions now follow.

Population. We have taken from Dr. A. Stukel's projection of population the one which assumes net immigration of 50,000 people per annum over the whole period (see Appendix E). Mortality rates are assumed to maintain their downward trend, and fertility rates decline except in the youngest fertile age group. The projected population has a fairly steady growth rate of 2¼ per cent throughout the 30 years of projection 1961–91. Over the historical period 1926–61 it had been 1.9 per cent; but in the post-war 1946–61 it had risen to the very high rate of 2½ per cent, a rate which means doubling every 28 years.

Civilian non-institutional population age 14 and over was also projected by Dr. A. Stukel (see Appendix E). The results are shown in PR–1, separated into male and female. For the historical period the Yukon and Northwest Territories (YNT) are excluded, but in the projected years they are included.

Participation Rates. For this projection only the total male and female participation rates were analysed and projected. The downward trend for the males, discussed in Chapter 6, was projected forward in slightly moderated form, declining from 80.0 per cent in 1961 to 75.0 per cent in 1991. The upward trend for women was also moderated in projecting forward. It grows from 28.8 per cent in 1961 to 38.0 per cent in 1991.

The implicit combined rate for men and women grows gently over the period 1961–91 (Not shown in PR–1).

The Labour Force. Under these assumptions the labour force (PR–1: $N_{1-M} = N_1^{\bullet} + N_{peY}$ for YNT)[1] grows from 6,518 thousand plus an estimated 11 thousand for Yukon and Northwest Territories in 1961 to 13,100 thousand (including YNT) in 1991. (Growth rate 2 ⅓ per cent.)

Rate of Unemployment, N_u^o. As discussed in Chapter 6, it was assumed for Projections 1 and 2 that government policy would get the rate of unemployment down to 4 per cent by 1966, and would keep it there as a trend for the remainder of the projected period. This assumption made it possible to calculate the projected amounts of unemployment, N_u.

Total Employment. The labour force $N_{1-M}(N_1^{\bullet} + N_{peY}$ for YNT) less unemployment N_u gives $N_{peg} = N_e$, the level of employment. It grows in the projection from 1961 to 1991 at rate of 2½ per cent. This includes the effect of the reduction of unemployment from 7.2 per cent in 1961 to 4 per cent in 1966.

Hours of Work, h. On the basis of past trends in the reduction of hours of work, h, moderated in the post-war, a negative growth rate –.6712 per cent was used for the projection. Average hours per year (week) declined from 2,164 (41.5) in 1961 to 1,768 (33.9) in 1991.

Man-Hours, N_eh. Combining the employment and the hours projections we get a change in labour input from 13,114 million man-hours in 1961, to 22,234 in 1991, with a growth rate of 1¾ per cent.

Average Productivity Relative to Labour, p_L. The long-term growth rate of p_L, 1926–61, was 2.69 per cent. Over the post-war boom 1946–56, it was 3.61 per cent. In the recent period of American and Canadian slowdown it has been only 1.12 per cent. For this projection it was felt that if we stabilize our unemployment at 4 per cent or less by 1966, we can achieve 2.75 per cent growth in this productivity. This is the rate which was projected.

4. The Basic Result – The Volume of Total Output

The basic result of the projection is the trend in the level of total output which the assumptions generate. In this projection our first result is gross domestic product, civilian, which we convert by steps to GNP. We find GNP growing at rate 5.4 per cent in the first five-year period, as the economy returns to moderately high level employment in 1966. Its subsequent rate is around 4½ per cent, which comes close to the historical average *full employment growth rate* of 5 per cent.

Under these sustained growth rates of the size projected, GNP in 1957 dollars increases nearly fourfold in the 30 years of projection.

---

[1] Note again that N_{peY} is excluded from $N_1^{\bullet}$ in the historical period, but is included in the period of projection. $N_{peY} = 11$ thousand in 1961.

5. The Allocation of Output

As discussed in Chapter 6, the fundamental allocation of output is between consuming and saving-investing. In our analytical framework, consuming is separated into civilian and defence categories. After studying the trends in the proportions in this fundamental three-way allocation (Chapter 6), it was decided to project these proportions as follows:

$$\begin{aligned} C^{no} &= 75 \text{ per cent} \\ G^{o}_{M} &= 4 \\ S^{no} &= 21 \\ \hline GNP^{o} &= 100 \end{aligned}$$

In PR–1 these proportions have been used as constants, and applied to GNP throughout the projection.

Total National Consumption. C^n. This large component grows at the same rate as GNP in the projection, and increases by a little less than a factor of four over the thirty-year period.

Public Consumption, C_g. This component of total national consumption represents all government spending for other than fixed investment and defence. As a proportion of C^n, C_g/C^n has been on a rising trend since 1946. This trend, slightly moderated, was projected on a straight line from 13.2 per cent in 1961 to 17.5 per cent in 1991.

The outcome of this in PR–1 is to give C_g a growth rate from 1961 to 1991 of 5½ per cent. This happens to be the same rate it had 1956–61, though in the total post-war it was 8 per cent. At the 5½ per cent rate, public consumption is projected to increase fivefold in the thirty-year period to 1991.

Private Consumption, C. With public consumption growing at a faster rate than total national consumption, private consumption C must grow at a slightly slower rate. Its rate over the 30 years projected is 4¼ per cent, and it increases by a factor somewhat less than four.

This growth rate is higher than C has experienced in past periods, but can be rationalized by the higher population growth rate in the projection plus the high employment assumption.

Allocation of Private Consumption into Non-durable Goods, C_{nd}*, Durable Goods,* C_d*, and Services,* C_s. On the basis of the post-war trends in the proportions of C allocated to these broad categories, the following linear trends were projected.

	C^o_{nd}	C^o_d	C^o_s	
1961	51.3	11.7	37.0	per cent
1991	45.0	14.0	41.0	per cent

This reflects an increasing allocation in the rich society to curable goods, and to services.

Government Expenditure on Goods and Services, G. We recall that this category includes all public spending on current consumption C_g, defence G_M, and investment GI_g. In PR–1 we projected this aggregate on the basis of its proportion to GNE, G°. This proportion displayed a rising trend in the post-war, and it was projected from 19.1 per cent in 1961 to 25.1 per cent in 1991. As a result G increased fivefold in the projection, at a growth rate of 5½ per cent. This happens to be equal to its long-range growth rate in the past, 1926–61.

Government Investment, GI_g. In PR–1 this component is found as a remainder. $GI_g = G - C_g - G_M$. It increases over sixfold in the 30 years of projection, with a growth rate of 6 ⅓ per cent.

Private Sector Savings – Investment. This is also found as a remainder in PR–1. It increases over threefold in the projection, with a growth rate of 4¼ per cent.

The Standard of Living. A rough indicator of this important concept is found in national consumption per capita, c^n. To obtain a more complete picture of standard of living and indeed of economic welfare in general, we would need to consider the distribution of income, the extent of consumer and social choice in the general allocation of output, the hours of work, and the degree of unemployment, as well as other indicators of economic well-being.

c^n had a long-term historical growth rate of 1.7 per cent, and nearly doubled 1926 to 1961. In PR–1 its growth rate increases to 2.8 per cent as the economy returns to high employment by 1966. Over the 30 years of projection, standard of living nearly doubles, and has a growth rate of 2¼ per cent.

National Consumption of Services, C_s^n. The demand for health services in the wealthy and growing Canadian economy will occur within the framework of the over-all demand for services. National consumption of services C_s^n, consisting of private use C_s and public use C_g was 34½ per cent of GNP in 1961. The two components are already determined in our projection. The sum $C_s^{n\circ}$, as a percentage of GNE, grows to 38½ in 1991. The services C_s^n increased more than threefold in the historical period, with a growth rate of 3½ per cent. In the 30 years of projection they increase well over fourfold, with a growth rate of 5 per cent.

6. Alternative Assumptions and Results

In case the assumptions for Projection No. 1 were thought to be overly optimistic, it was decided to test and record the effects of less optimistic assumptions on the growth paths of output and the standard of living. The most crucial and sensitive assumptions for this projection were the percentage unemployed N_u°, and the growth rate in "productivity", or real output per man-hour, ${}^\circ p_L$. It was decided to increase the former from 4 to 5 per cent, and to reduce the latter from 2¾ to 2¼ per cent.

These assumptions were changed in two stages, to make possible an analysis of the separate effects of each assumption. In the first stage only the unemployment assumption was changed. The results for this stage are now tabulated.

TABLE 1

REVISED VALUES OF GROSS NATIONAL PRODUCT AND STANDARD OF LIVING FOR PR–1 WHEN ASSUMPTION FOR N_u^o IS CHANGED FROM 4 TO 5 PER CENT OF CIVILIAN LABOUR FORCE

Year	Gross National Product GNP	Growth Rate ^oGNP	Standard of Living c^n	Growth Rate $^oc^n$
	m 57 $	%	1–57 $	%
1961	34,529	–	1,444	–
1966	44,449	5	1,643	2½
1971	55,553	4½	1,844	2¼
1976	68,994	4½	2,051	2
1981	85,154	4¼	2,261	2
1986	105,372	4½	2,505	2
1991	131,213	4½	2,803	2¼

Next, leaving unemployment at 5 per cent, we let the growth rate of productivity p_L fall to 2¼ per cent. The results of this second stage of revised assumptions are recorded in Table 2.

TABLE 2

REVISED VALUES OF GROSS NATIONAL PRODUCT AND STANDARD OF LIVING FOR PR–1, WHEN ASSUMPTION FOR N_u^o IS CHANGED FROM 4 TO 5 PER CENT, AND FOR ^op_L IS CHANGED FROM 2¾ TO 2¼ PER CENT

Year	GNP m 57$	^oGNP %	c^n 1–57$	$^oc^n$ %
1961	34,529	–	1,444	–
1966	43,377	4½	1,603	2⅛
1971	52,909	4	1,756	1¾
1976	64,126	4	1,906	1¾
1981	77,239	4	2,051	1½
1986	93,275	4	2,217	1½
1991	113,348	4	2,421	1¾

With the assumptions of Table 1 we get a slightly lower growth path, with only minor reductions in growth rates. The latter remain at substantial levels, and the standard of living still nearly doubles in the thirty years.

In Table 2 our assumptions are little more compatible since a lower rate of employment would tend to be associated with a slower growth in productivity. Even with these assumptions, however, we still get a substantial growth rate in GNP. The standard of living no longer doubles of course, but it does increase to 1 ⅔ in real terms of its 1961 value over the thirty-year period.

7. Current Dollar Projections of GNP

Forecasting and projection are best carried out in physical volume terms, with quantities measured in the fixed prices or fixed price level of a base period. Having reached real volume or physical value estimates in the constant dollar units of the base period, it is useful for some purposes to attempt to convert these to their money costs in market prices. To do this one must attempt to project future movements of price levels. These will be composed of trends, cycles and irregular movements. Here we attempt to project only a trend in the implicit price index of GNE.

The long-term growth rate per annum for the price level of GNE, from 1926 to 1962 is 2 ⅛ per cent. The corresponding trend rate for a more recent

TABLE 3

PROJECTED GNP_m IN CURRENT DOLLARS WITH DIFFERENT ASSUMPTIONS FOR THE RATE OF UNEMPLOYMENT (N_u^o) AND THE GROWTH RATE OF "PRODUCTIVITY" ($^o p_L$), USING ORIGINAL AND REVISED [1] ESTIMATES OF GNP_m FOR 1961 (millions of current dollars [2])

Year	N_u^o 4%, $^o p_L$ 2¾%		N_u^o 5%, $^o p_L$ 2¼%	
	Original Estimate of GNP_m, 1961	Revised Estimate of GNP_m, 1961	Original Estimate of GNP_m, 1961	Revised Estimate of GNP_m, 1961
1961	36,844	37,421	36,844	37,421
1966	52,760	53,587	50,953	51,751
1971	72,597	73,734	68,416	69,487
1976	99,244	100,798	91,283	92,713
1981	134,841	136,953	121,036	122,932
1986	183,681	186,558	160,903	163,423
1991	251,791	255,734	215,247	218,618

(1) As explained in Appendix B, pp. 1 and 2, it has generally been necessary to work with the original estimates of the national accounts which were available in the summer of 1962. However, in the case of this table it was found to be useful for other studies of the Royal Commission on Health Services if we also included the revised estimates of GNP_m found in *National Accounts, Income and Expenditure*, 1962, Dominion Bureau of Statistics, August, 1963.

(2) The compound growth rate per annum assumed for the price level was 1.94 per cent.

period, 1954 to 1962 is 1.94 per cent. This latter growth rate was used for projecting GNP in current dollars from 1961 to 1991. The price level of GNE, projected with this growth rate, was then applied to the constant dollar projections of GNP which are found in the Appendix to this chapter. The resulting current value or money value projections of GNP_m is found in the first column of Table 3 above. The second column of this table represents the same projection but starts from a revised 1961 base, the improved GNP_m estimate which appeared in the summer of 1963. In column 3 the price level of GNE is applied to the real GNP values of Table 2, in which lower assumptions about the employment rate and the productivity trend were used. Finally in column 4 of Table 3 the projection of column 3 is started from the same revised 1961 base used for column 2.

The values in Table 3 provide us with a more realistic picture of the kind of money aggregate we can anticipate for GNP_m in the future. The current dollar values turn out to be much higher than the real volume or constant dollar values, since the price level of GNE increased 6.7 per cent from 1957 to 1961, and then the growth rate of 1.94 per cent causes this level to rise by 21.2 per cent every ten years.

8. Conclusions

In our projection PR–1 we see that, with a reasonable management of our economic affairs in the next thirty years, the Canadian GNP can increase nearly fourfold. Population does not quite double. The standard of living can then nearly double, with a growth rate of 2¼ per cent.

The service side of the economy appears likely to grow at an even faster rate than output in general, since our society is allocating an increasing proportion of output to services, both private and public. It is within this expanding service area that the health services take their place, and can be viewed in perspective. The demand for them may grow for a while at least at the rate for total services, as the wealthy society pays increasing heed to its health and welfare. Rationalization of the finance and the supply of these services would permit these demands to be met without excessive price increases.

Our economy is fully capable of providing the 5 per cent growth rate in the services, as well as all of the other elements of this projection. The rates are realistic in terms of potential, or in terms of a high growth path. But the picture presented in this projection will not be achieved unless both public and government set up clear economic and social goals, and this is followed by careful policy planning aimed at a realization of these objectives.

APPENDIX TO CHAPTER 7

CANADIAN ECONOMIC GROWTH, 1926–1991
PROJECTION No. 1

	1	2	3	4	5	6	7	8	9	10	11	12	13
Year	Total Population	Civilian Non-Instit. Population Age 14 and Over		Participation Rates of Civil. Non-Instit. Population Age 14 and Over		The Labour Force (Civilian)			Rate of Unempl. Rel. to Civil. Lab. Force	Un-employ-ment	Total Employ-ment (Civil-ian)	Average Hours of Work	
		Men	Women	Men	Women	Men	Women	Total				Per Year	Per Week
Symbol	N	N_{14m}	N_{14f}	pr_m	pr_f	N_{lm}	N_{lf}	N_l	N_u^o	N_u	N_e	h	h_w
Units	June 1 t	June 1 t	June 1 t	ann. av. %	ann. av. %	ann. av. t	ann. av. t	ann. av. t	ann. av. %	ann. av. t	ann. av. t	1 hour	1 hour
1926...........	9,451											2,867	54.98
1931...........	10,376											2,653	50.88
1936...........	10,950											2,641	50.51
1941...........	11,507											2,734	52.43
1946...........	12,292	4,399	4,379	85.2	24.7	3,746	1,082	4,828	3.4	166	4,671	2,447	46.93
1951...........	14,009	4,857	4,874	83.9	23.5	4,076	1,147	5,223	2.7	143	5,089	2,289	43.90
1956...........	16,081	5,397	5,408	82.2	24.9	4,436	1,346	5,782	3.4	197	5,596	2,249	43.01
1961...........	18,238	5,980	6,030	80.0	28.8	4,782	1,736	6,518	7.2	469	6,060	2,164	41.50
1966...........	20,296	6,702	6,832	77.5	32.5	5,194	2,220	7,415	4.0	297	7,118	2,092	40.12
1971...........	22,590	7,502	7,694	77.0	33.6	5,777	2,585	8,362	4.0	334	8,028	2,023	38.80
1976...........	25,234	8,349	8,602	76.5	34.7	6,387	2,985	9,372	4.0	375	8,997	1,956	37.41
1981...........	28,247	9,249	9,546	76.0	35.8	7,022	3,418	10,440	4.0	418	10,022	1,891	36.27
1986...........	31,546	10,248	10,617	75.5	36.9	7,737	3,918	11,655	4.0	466	11,188	1,829	35.08
1991...........	35,107	11,457	11,860	75.0	38.0	8,593	4,507	13,100	4.0	524	12,576	1,768	33.91

PROJECTION No. 1 (Cont'd.)

	14	15	16	17	18	19	20	21	22	23	24	25
Year	Total Man-Hours of Labour-Civilian	Real Output Per Man-Hour	Gross Domestic Product-Civilian	Defence Value Added -Ratio to GDP_c	Defence-Value Added	Gross Domestic Product	Interest and Dividends Paid Abroad-Ratio	Interest and Dividends Paid Abroad	Interest and Dividends Rec'd from Abroad-Ratio	Interest and Dividends Received from Abroad	Gross National Product	Compound Annual Growth Rates
Symbol	N_eh	PL	GDP_c	G_{MI}/GDP_c	G_{MI}	GDP	π_{di}/GDP_c	π_{di}	π_{id}/GDP_c	π_{id}	GNP	^oGNP
Unit	m.m-h.	1 57$	m 57$	r	m 57$	m 57$	r	m 57$	r	m 57$	m 57$	% p.a.
1926..........	9,951	1.0416	10,365	.001544	16	10,381	.03801	394	.0055403	56	10,043	↑
1931..........	9,492	1.1257	10,685	.001685	18	10,703	.07319	782	.01011	108	10,029	
1936..........	9,780	1.1398	11,147	.001794	20	11,167	.06423	716	.01534	171	10,622	
1941..........	11,666	1.3871	16,182	.05080	822	17,004	.03547	574	.007107	115	16,545	3.591
1946..........	11,430	1.7519	20,024	.02667	534	20,558	.02247	450	.005194	104	20,212	
1951..........	11,649	2.1166	24,656	.01030	254	24,910	.02000	493	.005070	125	24,542	
1956..........	12,585	2.4971	31,426	.01451	456	31,882	.01651	519	.004614	145	31,508	
1961..........	13,114	2.6396	34,616	.01384	479	35,095	.02175	753	.005402	187	34,529	↓
1966..........	14,891	3.0231	45,017	.01362	613	45,630	.02085	939	.005000	225	44,916	5.4
1971..........	16,241	3.4622	56,230	.01339	753	56,983	.01995	1,122	.005000	281	56,142	4.6
1976..........	17,598	3.9652	69,780	.01317	919	70,699	.01904	1,329	.005000	349	69,719	4.4
1981..........	18,952	4.5412	86,065	.01295	1,115	87,180	.01814	1,561	.005000	430	86,049	4.3
1986..........	20,463	5.2010	106,428	.01272	1,354	107,782	.01724	1,835	.005000	532	106,479	4.4
1991..........	22,234	5.9566	132,439	.01250	1,655	134,094	.01634	2,164	.005000	662	132,592	4.5

PROJECTION No. 1 (Cont'd.)

	26	27	28	29	30	31	32	33	34	35	36	37
Year	National Consumption as Prop. of GNE	National Consumption	Public Cons., Civilian, as Prop. of Nat. Cons.	Public or Gov't Consumption	Private Consumption	Defence Expend. as Proportion of GNE	Defence Expenditure	National Saving	National Saving Ratio	Per Cent of Total Consumer Spending		
										Non-Durable Goods	Durable Goods	Services
Symbol	C^{no}	C^{n}	C_g/C^{n}_x 100	C_g	C	G^o_M	G_M	S^n	S^{no}	C^o_{nd}	C^o_d	C^o_s
Units	%	m 57$	%	m 57$	m 57$	%	m 57$	m 57$	%	%	%	%
1926	75.1	7,545	10.2	773	6,772	0.3	34	2,463	24.5	49.39	8.49	42.12
1931	89.7	8,994	11.8	1,059	7,935	0.4	41	995	9.9	56.77	7.74	35.49
1936	85.5	9,085	10.2	930	8,155	0.5	56	1,480	13.9	57.22	8.03	34.75
1941	68.1	11,275	10.4	1,176	10,099	12.6	2,090	3,179	19.2	57.62	7.85	34.53
1946	74.6	15,074	7.5	1,128	13,946	6.8	1,383	3,755	18.6	59.82	7.05	33.13
1951	70.7	17,360	9.9	1,723	15,637	5.3	1,303	5,880	24.0	58.06	10.98	30.95
1956	70.2	22,129	12.0	2,651	19,478	6.0	1,890	7,489	23.8	51.53	12.99	35.48
1961	76.3	26,345	13.2	3,486	22,859	4.2	1,452	6,732	19.5	51.29	11.71	37.00
1966	75.0	33,687	13.92	4,689	28,998	4.0	1,797	9,432	21.0	50.25	12.08	37.67
1971	75.0	42,106	14.63	6,160	35,946	4.0	2,246	11,790	21.0	49.20	12.47	38.33
1976	75.0	52,289	15.35	8,026	44,263	4.0	2,789	14,641	21.0	48.15	12.85	39.00
1981	75.0	64,537	16.07	10,371	54,166	4.0	3,442	18,070	21.0	47.10	13.23	39.67
1986	75.0	79,859	16.78	13,400	66,459	4.0	4,259	22,361	21.0	46.05	13.61	40.34
1991	75.0	99,444	17.5	17,403	82,041	4.0	5,304	27,844	21.0	45.0	14.0	41.0

PROJECTION No. 1 (Concl.)

	38	39	40	41	42	43	44	45	46
Year	Private Consumption Components			National Consumption Per Capita		Total Gov't Spending as Proportion of GNE	Total Gov't Spending	Gov't Investment	Total Private Sector Savings
	Non-Durable Goods	Durable Goods	Services	Absolute Value	Growth Rates				
Symbol	C_{nd}	C_d	C_s	c^n	$^oc^n$	G^o	G	GI_g	$S^n - GI_g$
Units	m 57$	m 57$	m 57$	1—57$	%p.a.	%	m 57$	m 57$	m 57$
1926...........	3,345	575	2,852	798.3		10.3	1,034	227	2,236
1931...........	4,505	614	2,816	866.8		15.1	1,513	414	581
1936...........	4,666	655	2,834	829.7		11.8	1,254	268	1,212
1941...........	5,819	793	3,487	979.8	1.7	20.0	3,302	36	3,143
1946...........	8,343	983	4,620	1,226.3		14.8	2,991	480	3,275
1951...........	9,080	1,718	4,840	1,239.2		15.1	3,713	687	5,193
1956...........	10,037	2,530	6,911	1,376.1		18.0	5,664	1,123	6,366
1961...........	11,724	2,676	8,459	1,444.5		19.1	6,608	1,670	5,062
1966...........	14,571	3,503	10,924	1,659.8	2.8	20.1	9,028	2,542	6,890
1971...........	17,685	4,482	13,778	1,863.9	2.3	21.1	11,846	3,440	8,350
1976...........	21,313	5,688	17,263	2,072.2	2.1	22.1	15,408	4,593	10,048
1981...........	25,512	7,166	21,488	2,284.7	2.0	23.1	19,877	6,064	12,006
1986...........	30,604	9,045	26,810	2,531.5	2.1	24.1	25,661	8,002	14,359
1991...........	36,918	11,486	33,637	2,832.6	2.3	25.1	33,281	10,574	17,270

CHAPTER 8

PROJECTION NUMBER TWO

In this projection a slightly different and more complex theoretical framework is used. Population is still the foundation stone of the projection, but now we use a more sophisticated and general form of the production relationship. Also in deriving the labour force from population we study participation rates in detailed age – sex groups. We still find it necessary to assume the rates of employment and unemployment, which means that we assume that government will keep effective demand in a certain necessary relationship to the conditions of supply. As in Projection No. 1 we shall assume that, in so regulating demand, government is able to achieve by 1966 a rate of unemployment of 4 per cent. To simplify the projection this constant rate is assumed from 1966 to 1991. We can remind ourselves again that while this represents a moderately high rate of employment, a higher and more humane goal would be 2 per cent. Both domestic and foreign experience (e.g., Sweden, Holland, United Kingdom, Australia, New Zealand) reveal that this higher goal is feasible.

A further difference in this projection is that we attempt a little more detail in the allocation of output, making a projection of capital inflow, and of the components of private investment in fixed capital.

1. The Model Used for Projection No. 2 (PR-2)

In PR–2, tabulated in the appendix at the back of this chapter, man-hours of labour input are projected using the same general approach as in PR–1. But now the participation rate of each sex – age group is studied and projected separately. Because of this we should have a little more precision in the projection of the labour force.

Suppose we symbolize our final man-hours estimate as $N_e h = L$. Then our production function can be expressed as

(1) $O = A\, f(L,K)$. Following the development of Chapter 3, we proceed to deduce a growth rate formula for output, in terms of the growth rates of factor inputs.

(2) $\dot{O} = y_L \dot{L} + y_K \dot{K} + \dot{A}$. y_L and y_K are the shares of the factors L and K in national output.

Suppose now we make the assumption that the capital/output ratio is approximately constant. Then

(3) $\frac{K}{O} = k; \; {}^{\cdot}K = {}^{\cdot}O.$

Substituting in (2), and recalling that $y_L + y_K = 1$, we obtain

(4) ${}^{\cdot}O = y_L \, {}^{\cdot}L + (1-y_L){}^{\cdot}O + {}^{\cdot}A.$

(5) ${}^{\cdot}O = {}^{\cdot}L + \frac{{}^{\cdot}A}{y_L}.$ This is the "golden-age" growth path of Chapter 3.

This is a remarkable result, for it enables us to project the growth of output using a production function, but without actually having to specify the precise form of this function.[1] We need only project the growth in the labour force and in technical progress, as well as any trend in the share of labour. In using the form (1) we recall however that it carries the implicit assumption that technical progress is neutral (cf. Chap. 3). We have also apparently assumed that the capital/output ratio remains constant. But historically its value has ranged from the order of 4 in the 1920's to 2.5 in the post-war. However its trend during the post-war has been upward, from 2.3 in 1946 to 2.5 in 1956 and 2.9 in 1961. How much of the latter trend is due to unemployment is uncertain, though it could be estimated.

The assumption of a constant k would, in any event, appear to be a weakness in PR-2. But it turns out that we have not really made such a drastic assumption. We have in fact only assumed that k remains constant during each separate five year "stride" in the projection. From stride to stride, k can vary, for we have allowed y_L to vary in this projection, and $y_L = 1 - y_K = 1 - rk$. Since y_L is projected on a gentle upward trend, this implies a slight downward trend in the product rk.

There is a further shortcoming with respect to (5), but fortunately it can be corrected. This formula is meant to apply to small changes in small time periods. But our projection makes 5-year strides, so that neither the changes nor the times period are small. To correct for this we must shift the formula over to finite differences.

(6) $\Delta O = A\Delta f + f\,\Delta A + \Delta A \Delta f.$

(7) $\frac{\Delta O}{\Delta t}\frac{1}{O} = \frac{A\Delta f}{(\Delta t)Af} + \frac{f\,\Delta A}{(\Delta t)Af} + \frac{\Delta A \Delta f.}{(\Delta t)Af}$

In our projection Δt is 5 years. To simplify the formula we accordingly make 5 years our unit of time, so that Δt becomes equal to 1. Also

(8) $\Delta f = \frac{\partial f}{\partial L}\Delta L + \frac{\partial f}{\partial K}\Delta K = \frac{\partial f}{\partial L} . \frac{L}{L} . \frac{Af}{Af} . \Delta L + \frac{\partial f}{\partial K} . \frac{K}{K} . \frac{Af}{Af} . \Delta K = f(y_L \, {}^{\cdot}L + y_K \, {}^{\cdot}K).$

[1] This formula may seem to be even more remarkable since it appears to be independent of the saving ratio. But this is an illusion, since the relation K/O = k implies a specific saving ratio. We have $\frac{GI-D}{O} = \frac{k\Delta O}{O}$, giving $s = k\,(d + {}^{\cdot}L + {}^{\cdot}A/y_L)$. s is accordingly "locked in" by the other conditions of growth in the economy. Cf. Chapter 3, Formula (29).

With this result we transform (7) to

(9) $\dot{}O = y_L\dot{}L + y_K\dot{}K + \dot{}A + \dot{}A(y_L\dot{}L + y_K\dot{}K)$.

This formula enables us to estimate $\dot{}A$ for finite changes, and in terms of the five-year growth rates of observable values. Thus

(10) $\dot{}A = (\dot{}O - y_L\dot{}L - y_K\dot{}K) / (1 + y_L\dot{}L + y_K\dot{}K)$.

We assume that for each 5 years stride, and at full employment, $K/O = k$, and $\dot{}O = \dot{}K$. Hence

(11) $\dot{}O(1 - y_K - \dot{}Ay_K) = y_L\dot{}L(1 + \dot{}A) + \dot{}A$.

(12) $$\dot{}O = \frac{\dot{}Ly_L\ (1 + \dot{}A) + \dot{}A}{y_L\ (1 + \dot{}A) - \dot{}A}.$$

Formula (12) is the engine of projection used in Projection No. 2. Two basic growth rates must be projected independently to make this projection work. One is the growth rate of labour input (as was also the case in PR–1). The second is the growth trend in technical change A.

To combine these two basic rates together in the growth rate formula we must also project forward any trend in the share of labour in total output.

Let us now look first at the data and projections of these basic parts of formula (12) and then turn to the outcome.

2. Basic Assumptions of Projection No. 2

The Labour Force N_{I-M}. The opening part of PR–2 is devoted to projecting the detailed sex and age groups of the labour force on the basis of Dr. A. Stukel's population projection (Appendix E) and of projected sex-age participation rates The trends in these rates were discussed in Chapter 6. Here we can recall the tendency for male participation rates to decline in the age groups 14-19, 20-24, and 65 and over. These trends were projected forward graphically, and moderated where it was felt that they could not continue indefinitely at their recent historical rates of decline. The result was a gentle decline for the over-all male rate throughout the projection.

Female participation rates by comparison have been rising rather drastically in the recent historical period, for all ages but the 14-19 group. These too were projected forward graphically, and in most cases moderated after 1966 when it seemed that the upward trend could not continue indefinitely at its past rate. The over-all participation rate for women is derived from the individual age group rates. It came out with a pronounced upward trend as might be expected on the basis of the individual rates.

Although there were over 2½ times as many men as women in the labour force in 1961, the larger positive growth rate of the women's participation was sufficiently great in absolute terms to more than offset the absolutely smaller but negative rate for the men. The combined participation rate for men and women

consequently displays a gentle upward trend in the projection. It moves from 54.3 per cent in 1961 to 55.3 per cent in 1991. By comparison, the combined participation rate for 1991 in PR–1 was 56.2.

The total civilian labour force (N_{I-M}) in this projection (incl. YNT) grows from (6518 + 11) thousand (t) in 1961 to 12,898t in 1991. This compares with 13,100t in 1991 in PR–1. The growth rate of the labour force in PR–2 is 2¼ per cent compared to 2⅓ per cent in PR–1.

Man-Hours of Labour Input, $N_e h = L$. To move from labour force to man-hours we use the same assumptions about the rate of unemployment and the trend in hours as were used in PR–1. As a result man-hours increase from 13,114 million (m) in 1961 to 21,891 m in 1991. This compares with 22,234 m in PR–1. The over-all growth rate projected in PR–2 is 1¾ per cent, the same as in PR–1, to the nearest ¼ per cent. This compares with the historical rate of only ¾ per cent (Chapter 6). Our projected rate is higher mainly because of more rapid population growth, rising participation rate, and the return to high employment.

Technical Change, A. The 35-year historical growth rate in this variable was 1.7 per cent. It was projected forward at this rate. When this rate is compounded for a five-year period we obtain a growth of 8.794 per cent, as found in PR–2.

Labour's Share in Output, y_L. It has often been assumed for theoretical analysis that the shares of labour (y_L) and capital (y_K) in total income are constant in the long run. Recent national income data however do not support this assumption, and reveal a rising share of labour income. (Cf. also [108]). This development can presumably be accounted for by the increasing education and skill required in the labour force, combined with the increasing abundance of physical capital in the rich society. At the same time labour supply becomes further reduced relative to capital as hours of work are reduced, and as labour and professional associations increase training requirements. All of these developments tend to increase the marginal productivity of labour and its price, relative to the corresponding values for physical capital, even when technical change is neutral. But they also increase the quantity of capital relative to labour. The outcome in terms of factor shares accordingly cannot be predicted on theoretical grounds. However we discover empirically that the labour share is increasing.

In the Canadian data labour income (civilian), as a proportion of net national income at factor cost, has risen from 57.3 per cent in 1926 to 67.6 per cent in 1961.[1]

In this study y_L was taken as the ratio of civilian wages, salaries and supplementary labour income to civilian Gross Domestic Product, less the residual error and less indirect taxes less subsidies, all in 1957 dollars. y_L increased from, .4783 in 1926 to .5853 in 1961 (Table E-2-5). In PR–2 it is projected on a straight line trend to .6500 in 1991.

---

[1] *National Accounts, 1958* and *1962*, Dominion Bureau of Statistics, Ottawa: Queen's Printer.

To elaborate further on the above explanation for this phenomenon, we might proceed as follows: The labour share of output can be thought of as consisting of "subsistence" wages for labour plus the returns on human capital. The latter is made up of education and skills. Then although man-hours L is falling relative to physical capital K, the composite of man-hours and human capital, appropriately weighted, may be growing as fast as or faster than K. This, combined with the supply reducing trends mentioned above (shorter hours and longer training), may be the appropriate analysis of the rising trend in y_L.

3. The Basic Result – The Volume of Total Output

Applying formula (12) above to our projections of $N_e h$, A and y_L we obtain first the 5-year growth rates of real civilian Gross Domestic Product, $\dot{}GDP_{c_5}$. From these rates we project GDP_c forward to 1991, and find that it moves from 34,616 m57$ in 1961 to 132,735 m57$ in 1991, with annual growth rate of 4½ per cent. This compares with 132,439 m57$ in PR–1, and growth rate 4½ per cent.

Defence value added G_{M1} was projected on the basis of assumptions about growth in the armed forces.

Each five year percentage growth rate in the armed forces was increased by one percentage point, to allow for increased value of training in the armed forces. The results obtained from this procedure are much less than those of PR–1 using a projected ratio.

Interest and dividends paid and received from abroad were projected as ratios to GDP_c (as in PR–1) from graphical analysis, and their projected values were then calculated by applying these ratios to GDP_c.

The resultant real GNP grows from 34,529 m57$ in 1961 to 132,100 m57$ in 1991. This is a fourfold increase, with growth rate of 4½ per cent.

4. The Allocation of Output

The basic allocation formula is the same as for PR–1.

$$
\begin{aligned}
C^{no} &= 75 \text{ pc} \\
G^{o}_{M} &= 4 \\
S^{no} &= 21 \\
\hline
GNP^{o} &= 100 \text{ pc}
\end{aligned}
$$

This is the kind of allocation between consuming and gross saving that we can expect when there is high employment.

Public Consumption, C_g. This is found using the same rising proportion of C^n as was used in PR–1. The growth rate of C_g in PR–2 over the thirty years is 5½ per cent (5½). (Figures in brackets reflect the corresponding growth rates in PR–1.)

Total Government Spending, G. Here again we use the same rising proportion of GNP as was used in PR–1. The growth rate in G is 5½ per cent (5½).

Government Investment, GI_g. This is found as a residual, after C_g and G_M are subtracted from G. Its growth rate proves to be 6⅓ per cent (6⅓). This speed-up in public investment can be considered in part to be necessary to handle the increased level of services anticipated for government; in part an allocation by a wealthy society to fill in our deficiencies of social capital (Galbraith [106]); and in part necessary for achieving the full employment of our economy on a high growth path. All three of these needs can be served by this investment prospect.

Capital Inflow, $-F.'$ A capital inflow permits the level of national real investment, GI^n, to exceed the level of national savings S^n. The capital inflow is equal to imports of goods and services F_1' minus exports of goods and services F_2'. It is thus equal to the negative of the current account balance, on a national accounts basis. In terms of our symbols, the capital inflow is equal to $F_1' - F_2' = - F' = GI^n - S^n - ½ R_2$, where $S^n = GNE - C^n - G_M$. (Note that $R_2 = 0$ for the projection years.) The capital inflow as a percentage of GNP, $- \acute{F}'^{\circ}$ (cf. Appendix A, Table C-2) is equal to the difference between $GI^{n\circ}$ and $S^{n\circ}$, except for the residual error.

Capital inflow became significant in Canada in 1950, when it was 1.2 per cent of GNP, and has continued at a high level until 1961. It rose to a maximum in 1956, when it was 5.0 per cent. By 1961 it had declined to 2.1 per cent.

In the projection it is assumed that as the Canadian economy becomes more mature we shall need and want less and less capital inflow. For while capital inflow helps speed up development, and relieves us of some of the responsibility of saving for our own development, it has two serious defects if continued too long. It places more and more of our resources under foreign ownership and control; and it has a partial effect of contributing to our unemployment since it encourages imports to be greater than exports, especially if we are on a flexible exchange rate. The problems for the future are further augmented, if the high exchange rate encourages us to consume more, so that some of the capital is applied to consumption rather than investment. These and related problems were discussed in Chapters 4 and 5. Again we can recall that an autonomous capital inflow augmented by the inducement of high domestic interest rates seems particularly inappropriate to an advanced economy with a variable exchange rate and suffering from a large volume of unemployment.

Because of these problems it is assumed that as Canada matures both natural economic forces and government policy will cause the capital inflow to diminish in relative terms though it may still continue to rise in absolute terms. In this projection capital inflow is taken to decline from 2.1 per cent of GNP in 1961 (excl. residual error) to approximately 0.0 per cent in 1991. The inflow is not shown separately in the tables of PR–2, but it can be readily found by subtracting national savings S^n from national investment GI^n. When these capital inflows are converted to percentages of GNP, we obtain for the five-year steps beginning with 1966: 1.0, 0.4, 0.5, 0.5, 0.1, -0.07 per cent.

Inventory Investment, ΔH. On the basis of graphical analysis it appeared that the ratio of inventory stocks H to GDP would slowly decline. One would expect such a declining trend on theoretical grounds, as communications and transportation improve, and with the developments in scientific inventory control aided by the electronic computers. Also a shift in the mix of production to a greater proportion of services may contribute to the declining trend in H/GNP.

This ratio was projected graphically from .3675 in 1961 to .3550 in 1966, and from there the linear trend was moderated to reach .3250 in 1991. From this trend it was possible to compute the corresponding annual ΔH values (Jan. 1–Dec. 31) which appear in PR–2. These represent, of course, growth trends only, without the usual business cycle effects. Their growth rate from 1966 to 1991 is 3 per cent.

Private Fixed Capital Investment. Given the allocations we have made so far, private investment in fixed capital can be taken as a residual. As a proportion of GNP in current dollars this category reached its highest value (23.0 per cent) in 1957. In 1961 it was 17.6 per cent. In our projection it declines to 14.7 per cent in 1966, which brings it closer to the values it had in the later 1920's, but above the values it took in the later 1930's. (In 1937 it was 12.0). It then slowly declines to 11.8 per cent in 1991.

Within this aggregate the three components – residential construction GI_d, non-residential construction GI_{PC}, and machinery and equipment, GI_M – take slightly different courses. The GI_d proportion of GNP ($GI^{\cdot}_d$) does not fall quite as fast as the other two, and $GI^{\cdot}_{PC}$ falls a little more than does $GI^{\cdot}_M$. These differences are only slight, but they reflect the possibility that the wealthy society may choose to put a little more resources into dwellings, and that plant and construction may become of less relative value than the increasingly complex machinery which it houses.

The growth rates of these three kinds of fixed investment in the projection are 3½, 2¾, and 3½ per cent respectively. Total private sector investment including inventories grows at rate 3¾ per cent.

5. Some Implications of our Projected Growth and Allocation

The Standard of Living, c^n. This variable grew historically at rate 1.7 per cent. In PR–2 it grows at 2.8 per cent as the economy returns to high employment by 1966. Over the thirty-year period 1961–1991 it has growth rate 2¼ per cent. In this period the standard of living nearly doubles. These results are the same as those obtained in PR–1.

Private Consumption Per Capita, $C/N = c$. This ratio grows from approximately 1,250 1957\$ in 1961 to 2,330 1957\$ in 1991. It also nearly doubles, with growth rate of 2 per cent. This is slightly less than the rate for c^n because of the increasing importance of public consumption.

National Consumption of Services, C_s^n. This variable is obtained by combining private consumption of services C_s with government consumption C_g. From 34½ per cent of GNP in 1961 it grows to 38½ per cent in 1991. Its growth rate in the projection is 5 per cent. Again these results are the same as we obtained in PR–1.

6. Conclusions

Projection No. 2 was carried out with a more detailed analysis of the labour force, and with a more general growth model than was the case with Projection No.1. Yet its general picture of likely Canadian growth at near full employment is substantially the same as that produced in PR–1. The standard of living of the Canadian people can double in the next thirty years.

In PR–2 we projected the allocation of output in a little more detail than was attempted in PR–1. In most instances, however, the same trends of allocation were used as for PR–1. New ground was broken only in the case of private sector investment, and capital inflow. Hence, as in PR–1, we find services growing at a faster rate than total production. The implications with respect to the future ability of the economy to provide substantially expanded health services does not need repetition, (see Chapter 7).

Again of course we find the public sector projected to grow at a faster rate than the private sector. Within this framework we find public investment growing rapidly, and private investment growing at a slower pace. We are short on social capital [Galbraith, 106]; and at the same time private investment may continue to be less of a dynamic force, as it has been in the 1957–1962 period. Should this happen, and no major labour-using innovations come along, only more rapid expansion of the public sector could give us high employment on a high growth path. The alternatives of higher private consumption, and/or more leisure, would give us full employment on a low growth path, but these choices may not be appropriate in the present and foreseeable world situation.

This trend of expansion of the public relative to the private sector need not nor should not continue indefinitely, for ultimately it would endanger our democracy. It can be looked upon as a movement toward a new equilibrium between the two sectors of the economy, necessitated by evolution in our social and economic structure, and motivated by a new awareness of what we might achieve as a whole society.

APPENDIX TO CHAPTER 8

CANADIAN ECONOMIC GROWTH
PROJECTION No. 2

	1	2	3	4	5	6	7	8	9	10
	Civilian Non-Instit. Population			Particip. Rates	Civilian Labour Force	Civilian Non-Instit. Population			Particip. Rates	Civilian Labour Force
	Provinces	Yukon and Northwest Terri-tories	Total – Canada			Provinces	Yukon and Northwest Terri-tories	Total– Canada		
Symbol		YNT	N_{14i}	$100pr_i$	$N_{1-M,i}$					
Units	June 1 t	June 1 t	June 1 t	Ann.Av. %	Ann.Av. t					
Age Groups	MALES			1966		MALES			1971	
14 – 19	1,118.2	2.4	1,120.6	34.00	381.0	1,252.6	2.7	1,255.3	32.20	404.2
20 – 24	699.1	2.9	702.0	89.75	630.0	908.3	3.3	911.6	88.80	809.5
25 – 34	1,172.0	5.7	1,177.7	97.77	1,151.4	1,313.3	6.5	1,319.8	97.77	1,290.4
35 – 44	1,233.9	3.8	1,237.7	97.70	1,209.2	1,238.1	4.3	1,242.4	97.70	1,213.8
45 – 54	1,028.6	2.5	1,031.1	96.10	990.9	1,134.8	2.8	1,137.6	96.10	1,093.2
55 – 64	729.7	1.4	731.1	86.83	634.8	852.0	1.6	853.6	86.83	741.2
65 +	701.3	1.0	702.3	25.00	175.6	780.8	1.2	782.0	24.50	191.6
Total	6,682.8	19.7	6,702.5	77.18	5,172.9	7,479.9	22.4	7,502.3	76.56	5,743.9
	FEMALES			1966		FEMALES			1971	
14 – 19	1,089.8	2.3	1,092.1	31.83	347.6	1,221.6	2.6	1,224.2	31.26	382.7
20 – 24	703.8	2.8	706.6	49.00	346.2	909.6	3.2	912.8	49.20	449.1
25 – 34	1,202.6	5.5	1,208.1	31.00	374.5	1,344.9	6.3	1,351.2	32.40	437.8
35 – 44	1,255.9	3.7	1,259.6	35.00	440.9	1,236.1	4.2	1,240.3	36.80	456.4
45 – 54	1,036.0	2.4	1,038.4	39.00	405.0	1,174.3	2.7	1,177.0	41.40	487.3
55 – 64	732.9	1.2	734.1	29.00	212.9	870.8	1.4	872.2	31.20	272.1
65 +	792.0	.9	792.9	6.67	52.9	915.9	1.0	916.9	7.54	69.1
Total	6,813.0	18.0	6,831.8	31.91	2,180.0	7,673.2	21.4	7,694.6	33.20	2,554.5
Grand Total	13,495.8	38.5	13,534.3	54.33	7,352.9	15,153.1	43.8	15,196.9	54.61	8,298.4

PROJECTION No. 2 (Cont'd.)

Age Groups	11	12	13	14	15	16	17	18	19	20
	MALES 1976					MALES 1981				
14 – 19	1,358.0	3.1	1,361.1	30.40	413.8	1,453.8	3.5	1,457.3	28.60	416.8
20 – 24	1,022.2	3.8	1,026.0	87.85	901.3	1,111.3	4.3	1,115.6	86.90	969.5
25 – 34	1,671.2	7.4	1,678.6	97.77	1,641.2	1,996.2	8.3	2,004.5	97.77	1,959.8
35 – 44	1,220.0	4.8	1,224.8	97.70	1,196.6	1,364.6	5.5	1,370.1	97.70	1,338.6
45 – 54	1,223.3	3.2	1,226.5	96.10	1,178.7	1,230.7	3.6	1,234.3	96.10	1,186.2
55 – 64	942.7	1.8	944.5	86.83	820.1	1,042.6	2.0	1,044.6	86.83	907.0
65 +	886.4	1.3	887.7	24.00	213.0	1,011.4	1.6	1,013.0	23.50	238.1
Total	8,323.8	25.4	8,349.2	76.23	6,364.7	9,210.6	28.8	9,239.4	75.94	7,016.0
	FEMALES 1976					FEMALES 1981				
14 – 19	1,325.8	2.9	1,328.7	30.69	407.8	1,414.0	3.3	1,417.3	30.12	426.9
20 – 24	1,022.0	3.7	1,025.7	49.40	506.7	1,112.8	4.2	1,117.0	49.60	554.0
25 – 34	1,670.2	7.3	1,677.5	33.80	567.0	1,987.9	8.1	1,996.0	35.20	702.6
35 – 44	1,242.8	4.7	1,247.5	38.60	481.5	1,385.5	5.4	1,390.9	40.40	561.9
45 – 54	1,251.8	3.0	1,254.8	43.80	549.6	1,233.6	3.4	1,237.0	46.20	571.5
55 – 64	997.0	1.6	998.6	33.40	333.5	1,130.8	1.8	1,132.6	35.60	403.2
65 +	1,067.9	1.2	1,069.1	8.41	89.9	1,253.9	1.4	1,255.3	9.28	116.5
Total	8,577.5	24.4	8,601.9	34.13	2,936.0	9,518.5	27.6	9,546.1	34.95	3,336.6
Grand Total	16,901.3	49.8	16,951.1	54.87	9,300.7	18,729.1	56.4	18,785.5	55.11	10,352.6

PROJECTION No. 2 (Cont'd.)

Age Groups	21	22	23	24	25	26	27	28	29	30
	MALES 1986					MALES 1991				
14 – 19	1,641.9	4.0	1,645.9	26.80	441.1	1,907.3	4.5	1,911.8	25.00	478.0
20 – 24	1,181.4	4.9	1,186.3	85.95	1,019.6	1,329.7	5.6	1,335.3	85.0	1,135.0
25 – 34	2,198.3	9.5	2,207.8	97.77	2,158.6	2,363.4	10.8	2,374.2	97.77	2,321.3
35 – 44	1,723.4	6.3	1,729.7	97.70	1,689.9	2,053.6	7.1	2,060.7	97.70	2,013.3
45 – 54	1,213.3	4.1	1,217.4	96.10	1,169.9	1,359.6	4.7	1,364.3	96.10	1,311.1
55 – 64	1,122.3	2.3	1,124.6	86.83	976.5	1,130.7	2.6	1,133.3	86.83	984.0
65 +	1,134.0	1.7	1,135.7	23.00	261.2	1,275.8	1.9	1,277.7	22.50	287.5
Total	10,214.6	32.8	10,247.4	75.30	7,716.8	11,420.1	37.2	11,457.3	74.45	8,530.2
	FEMALES 1986					FEMALES 1991				
14 – 19	1,596.2	3.8	1,600.0	29.55	472.8	1,849.2	4.2	1,853.4	29.0	537.5
20 – 24	1,180.0	4.7	1,184.7	49.80	590.0	1,324.4	5.4	1,329.8	50.00	664.9
25 – 34	2,191.4	9.3	2,200.7	36.60	805.5	2,349.9	10.5	2,360.4	38.00	897.0
35 – 44	1,711.3	6.2	1,717.5	42.20	724.8	2,029.6	7.1	2,036.7	44.00	896.1
45 – 54	1,241.9	3.9	1,245.8	48.60	605.5	1,384.6	4.5	1,389.1	51.00	708.4
55 – 64	1,206.4	2.0	1,208.4	37.80	456.8	1,191.3	2.2	1,193.5	40.00	477.4
65 +	1,458.5	1.5	1,460.0	10.15	148.2	1,694.9	1.7	1,696.6	11.00	186.6
Total	10,585.7	31.4	10,617.1	35.83	3,803.6	11,823.9	35.6	11,859.5	36.83	4,367.9
Grand Total	20,800.3	64.2	20,864.5	55.21	11,520.4	23,244.0	72.8	23,316.8	55.32	12,898.1

PROJECTION NO. 2 (Cont'd.)

	31	32	33	34	35	36	37	38	39	40	41
Year	Civilian Labour Force Incl. YNT	Rate of Unempl. Rel. to Civilian Labour Force	Unemployment	Total Employment Civilian	Man-Hours of Labour	Proportionate Five Year Change in Man-Hours	Proportionate Five Year Change in Technology Improv. Factor	Labour Share of GDP_c Adjusted	Proportionate Five Year Change in GDP_c	Gross Domestic Product Civilian	Defence Value Added
Symbol	N_{1-M}	$N^o{}_u$	N_u	N_e	$N_e h$	$\dot{}N_e h_5$	$\dot{}A_5$	y_L	$\dot{}GDP_{c5}$	GDP_c	G_{MI}
Units	Ann.Av.t	Ann.Av.%	Ann.Av.t	Ann.Av.t	m.m–h	r	r	r	r	m 57$	m 57$
1926............	3,578	3.0	107	3,471	9,951			.47829		10,365	16
1931............	4,110	12.9	532	3,578	9,492	–.04613	.07973	.54904	.03087	10,685	18
1936............	4,432	16.4	729	3,703	9,780	.03034	.09449	.53700	.04324	11,147	20
1941............	4,423	3.5	156	4,267	11,666	.19284	.22862	.51781	.45169	16,182	822
1946............	4,837	3.4	166	4,671	11,430	–.02023	.10822	.52866	.23742	20,024	534
1951............	5,232	2.7	143	5,089	11,649	.01916	.07289	.53942	.23132	24,656	254
1956............	5,793	3.4	197	5,596	12,585	.08035	.07235	.55648	.27458	31,426	456
1961............	6,529	7.2	469	6,060	13,114	.04203	–.02571	.58533	.10151	34,616	479
1966............	7,353	4.0	294	7,059	14,767	.12605	.08794	.60000	.30137	45,048	535
1971............	8,298	4.0	332	7,966	16,115	.09128	.08794	.61000	.25798	56,669	600
1976............	9,301	4.0	372	8,929	17,465	.08377	.08794	.62000	.24624	70,623	665
1981............	10,353	4.0	414	9,939	18,795	.07615	.08794	.63000	.23454	87,187	732
1986............	11,520	4.0	461	11,059	20,227	.07619	.08794	.64000	.23176	107,393	800
1991............	12,898	4.0	516	12,382	21,891	.08227	.08794	.65000	.23597	132,735	870

PROJECTION NO. 2 (Cont'd.)

	42	43	44	45	46	47	48	49	50	51	52	53
Year	Gross Domestic Product	Interest and Div. Paid Abroad	Interest and Div. Received from Abroad	Gross National Product	Compound Annual Growth Rate of GNP	National Consumption	Public or Government Consumption	Private Consumption	Defence Expenditure	National Saving	National Saving Ratio	Simple 5 year Growth Rate of National Consumption of Services
Symbol	GDP	II_{di}	II_{id}	GNP	^{o}GNP	C^n	C_g	C	G_M	S^n	S^{no}	$^{o}C^{n}_{s5}$
Units	m 57$	m 57$	m 57$	m 57$	% p.a.	m 57$	m 57$	m 57$	m 57$	m 57$	%	%
1926	10,381	394	56	10,043	↑	7,545	773	6,772	34	2,463	24.5	
1931	10,703	782	108	10,029		8,994	1,059	7,935	41	995	9.9	6.9
1936	11,167	716	171	10,622		9,085	930	8,155	56	1,480	13.9	–2.9
1941	17,004	574	115	16,545		11,275	1,176	10,099	2,090	3,179	19.2	23.9
1946	20,558	450	104	20,212		15,074	1,128	13,946	1,383	3,755	18.6	23.3
1951	24,910	493	125	24,542	3.591	17,360	1,723	15,637	1,303	5,880	24.0	14.2
1956	31,882	519	145	31,508		22,129	2,651	19,478	1,890	7,489	23.8	45.7
1961	35,095	753	187	34,529	↓	26,345	3,486	22,859	1,452	6,732	19.5	24.9
1966	45,583	939	225	44,869	5.378	33,652	4,684	28,968	1,795	9,422	21.0	30.6
1971	57,269	1,131	283	56,421	4.688	42,316	6,191	36,125	2,257	11,848	21.0	28.5
1976	71,288	1,345	353	70,296	4.496	52,722	8,093	44,629	2,812	14,762	21.0	27.3
1981	87,919	1,582	436	86,773	4.302	65,080	10,458	54,622	3,471	18,222	21.0	26.0
1986	108,193	1,851	537	106,879	4.256	80,159	13,451	66,708	4,275	22,445	21.0	25.6
1991	133,605	2,169	664	132,100	4.328	99,075	17,338	81,737	5,284	27,741	21.0	26.0

PROJECTION No. 2 (Concl.)

	54	55	56	57	58	59	60	61	62	63	64	65
Year	Private Consumption Components			National Consumption Per Capita		Total Government Spending	Government Investment	Bus. Gross Fixed Capital Formation			Change in Inventories Jan. 1 – Dec. 31	Total National Investment
	Non-Dur. Goods	Durable Goods	Services	Absol. Value	Growth Rate			Resid. Constr.	Non-resid. Constr.	Mach. and Equip.		
Symbol	C_{nd}	C_d	C_s	c^n	$^{o}c^{n}$	G	GI_g	GI_d	GI_{PC}	GI_M	ΔH	GI^n
Units	m 57$	m 57$	m 57$	1 – 57$	% p.a.	m 57$	m 57$	m 57$	m 57$	m 57$	m 57$	m 57$
1926........	3,345	575	2,852	798.3	↑	1,034	227	421	516	556	277	1,997
1931........	4,505	614	2,816	866.8		1,513	414	340	606	466	–338	1,488
1936........	4,666	655	2,834	829.7		1,254	268	304	345	421	–257	1,081
1941........	5,819	793	3,487	979.8		3,302	36	450	583	1,045	74	2,188
1946........	8,343	983	4,620	1,226.3	1.7	2,991	480	541	727	1,014	588	3,350
1951........	9,080	1,718	4,840	1,239.2		3,713	687	962	1,421	1,985	1,123	6,178
1956........	10,037	2,530	6,911	1,376.1		5,664	1,123	1,567	2,666	2,781	1,086	9,223
1961........	11,724	2,676	8,459	1,444.5	↓	6,608	1,670	1,329	2,460	2,201	–262	7,398
1966........	14,556	3,499	10,913	1,658.1	2.8	9,019	2,540	1,660	2,288	2,692	709	9,889
1971........	17,774	4,505	13,846	1,873.2	2.5	11,905	3,457	2,031	2,595	3,160	827	12,070
1976........	21,489	5,735	17,405	2,089.3	2.2	15,535	4,630	2,460	3,163	3,866	964	15,083
1981........	25,727	7,226	21,669	2,304.0	2.0	20,045	6,116	2,950	3,818	4,599	1,136	18,619
1986........	30,719	9,079	26,910	2,541.0	2.0	25,758	8,032	3,527	4,489	5,130	1,379	22,557
1991........	36,782	11,443	33,512	2,822.1	2.1	33,157	10,535	4,227	5,416	5,944	1,522	27,644

CHAPTER 9

AN ECONOMETRIC GROWTH MODEL

1. Introduction

Our purpose in the present study is to attempt to explain the forces behind the past growth of the Canadian economy, and to use this explanation as a basis for the projection of future growth. In Chapters 2, 3 and 4 we have already attempted to analyze the fundamentals of growth, and there our study separated into two areas – the *supply* potential, and the conditions of *demand* necessary to call this potential into being. The two are related in a dynamic sequence through the stock of capital. If demand is high savings and investment can be high, the stock of capital can grow faster, and so potential supply or the output ceiling can have both higher level and slope. We assume here that there are abundant investment opportunities arising from vertical growth, as well as those associated with horizontal growth. But if demand is low investment is inhibited, the stock of capital grows or declines, the labour force is not fully employed, and the supply potential or output ceiling is lower in level and has a lower slope (growth rate). The same kind of analysis could be applied to the influence of economic conditions (demand relative to supply) on population, the labour force, and the willingness of the labour force to invest in education and training. The impact of the latter is reflected in our models by the variable A, representing socio-technical progress and economic development.

In Chapter 3 we saw that growth can have both a horizontal and a vertical component. The former involves repeated duplication or replication of existing conditions, the latter an improvement in productivity and the standard of living. But neither of these kinds of growth can occur on a continuing basis at any significant rate without a corresponding growth or expansion of *demand*. It is of course vertical growth that a society essentially wants, but it may also encourage horizontal growth as a contributor to vertical growth through enlarging the market and scale of operations. Thus the kind of growth a society wants arises through the expansions and interactions of both *demand* and the *socio-technological* environment, with the latter growing in both quality and capacity. The two forces of demand and technology, both necessary for vertical growth, are indeed interdependent, for the technology creates new final products which act as a stimulus to demand; while innovations affecting only the supply of existing products may be deferred in the face of inadequate demand.

In Projections No. 1 and 2 we did not analyse demand. Instead we worked with what were essentially models of supply. We eliminated problems of demand by assuming that government policy would maintain demand at an appropriate level in relation to supply so that just four per cent of the civilian labour force would be unemployed. But now our objective is to move into the analysis of aggregate demand in the economic system, and it is for this reason that we must build an econometric growth model. This model should be comprehensive enough to allow us to analyse both demand and supply. We plan to use it for our third and final economic projection.

In the present chapter our purpose is to design and display the model to be used. While projection is the main purpose for which the model will be planned, it should also be able to give some broad guidance on the discovery of policies capable of dealing with problems of unemployment and slow economic growth.

2. The Nature of an Econometric Model

An econometric model attempts to explain the behaviour of an aggregated economic system, or of any subsector of such a system. in terms of the basic cause-effect relationships which underly the behaviour of the system. The model attempts to encompass and describe the complete economy treated as a unit "organism", with many interrelated "organs" and sub-systems. In the process of description, one direct causal relationship is developed (usually) to explain each endogenous variable in the economy. The relation is expressed as an equation, in which the endogenous variable being explained is put equal to a function of the other variables in the system which act on it directly as causes. The familiar consumption function is such a relation, and in its most simple form it expresses aggregate consumption as a function of aggregate income. An *endogenous* variable is one which is generated inside the economic system – is affected by other variables in the economy. The endogenous variables are consequently mutually interrelated – they affect each other. For example, the flow of income affects the level of consumption; but the amount of spending on consumption helps to determine the flow of income.

By contrast an *exogenous* variable is one which is generated outside of the economic system under consideration, and often by non-economic forces. Population, wars, international relations, scientific discoveries, resource discoveries, sociological and political trends, government behaviour in the short run – these represent the exogenous forces which impinge on an economic system. The exogenous variables exert great influence on the economic system, but there is little or no feed-back from the system to them. They exert a mainly one-way causation on the economic organism.

An economic model of the system then consists of the set of all of the basic relations, expressed as equations, within the system, and which, taken together, round out as complete a quantitative description as possible of the organism considered as a whole or as a unity. Successful quantitative description in this manner requires careful background study of economic institutions,

and of the anatomy and the behaviouristic characteristics of the total economic organism. Such a model gives us in concept an aggregative "general equilibrium". This "general equilibrium" is found by the simultaneous solution of the system of equations, for the endogenous variables, in terms of the exogenous and lagged variables. The equilibrium or solution is dynamic, moving through time under the influence of the moving exogenous forces, and of the successive changes in the lagged endogenous variables.

Each relationship is developed first as an hypothesis, using fundamental economic theory. It is then tested with the observed statistical data. On the basis of systematic discrepancies between the assumptions and the data, the original hypothesis may be revised many times before one is finally accepted, or is "not rejected by the data". Any hypothesis so accepted is of course still subject to further research and revision. The parameters of the relationship can then be estimated in numerical form. The hypothesis begins to take on the stature of a *theory*. Ultimately the whole model is tested and fitted to the data in one simultaneous statistical operation, which brings statistical techniques into harmony with the realities of economic general equilibrium. Now we have the very essence of econometrics – the *measurement of economic relationships*. But prior to and leading up to this measurement is the extensive programme of hypothesis testing – the testing of economic theory with observed data. In fact the term "theory" itself should probably be reserved for those hypotheses that have survived both rigorous testing on historical data, and successful prediction.

The model thus measured and fitted to historical data, with parameters now in numerical form, is called an econometric model.

At this stage each endogenous variable in the system is explained in quantitative form in terms of the main direct, proximate causal variables which influence it. Some of these explanatory variables are other endogenous variables in the system; others are lagged variables expressing delayed causation; and still others are exogenous. The exogenous variables have no explanatory equation, since they are not influenced by any variable in the system, although they exert influence on the variables in the model.

The set of exogenous variables can be divided into two classes – those that are truly exogenous (or almost so) and those that are treated as exogenous to keep the model small, or because the data required for the causal variables which might explain them are not available.

The exogenous and lagged variables in the model are combined into a set known as the *predetermined* variables. For any given values of the set of predetermined variables the endogenous variables can be determined by simultaneous solution of the system of equations. The endogenous variables now take on the role of dependent variables, while the predetermined set act as independent variables. This relationship provides us with the basis and the technique for using the model for projection. We project the exogenous variables independently over a sequence of years, and then solve the model for these same years to obtain the corresponding values of the endogenous variables. Through this sequence of solutions the model generates the projection of the current and

lagged endogenous variables. In projection over a sequence of years (as distinct from a single solution for one particular year) it is the exogenous variables alone which play the role of independent variables. Now both current endogenous and lagged variables act as (take the role of) dependent variables. The projection becomes, in effect, the time path or growth path of a dynamic, moving equilibrium of the endogenous variables in the model.

3. Broad Design of the Econometric Growth Model

The development and use of econometric growth models is still in its infancy, and hence the present attempt must be treated as experimental. Basically, however, what we want the model to do is to explain the growth in potential aggregate supply in the economy, and at the same time to analyse the growth in aggregate demand. The latter we will want to separate into what we feel are the main sectors of aggregate demand, from a growth point of view. Then we shall want the model to reveal how demand and supply interact on each other, through the level of employment, and through the growth in the stock of capital. For example, we shall want the model to show if and how insufficient demand for final goods can put the economy on a low growth path with a low growth slope.

Economic activity begins with the need and desire for final goods which, through the availability of purchasing power resulting from disposable income (including social welfare and other transfer payments) and wealth, can be translated into effective demand for final goods. The results of demand are observable in the modern economy in the spending of money for final goods. This brings about a supply response, the production of final goods. In the process of production income is earned by the factors of production-labour and capital. This income becomes a basis for subsequent demand, and so the "money" cycle is completed. The system becomes a continuous circuit of money flows in one direction and goods and factor flows in the opposite direction. The volume of flow, for certain periods of time such as a month or a year, is measured for various categories of goods and factors.

In order to facilitate these flows various stocks of goods and finance are held throughout the system. Each flow and stock is the resultant of an equilibration of forces influencing demand and forces influencing supply. In some markets the equilibration is delayed, and we get short-run solutions or temporary equilibria, while the system moves slowly toward a longer-run equilibrium.

It is basically the function of a model of the economy to explain the forces behind demand and supply for the major flows and stocks of the total economic system, and to portray the equilibration of these demands and supplies in the appropriate markets. Two causes may, however, prevent the econometrician from achieving such a "complete" model. One is that there may not be sufficient observed data to permit a complete model to be built. The second is that the complete model will tend to be quite large in terms of numbers of equations and variables. This would require considerable resources in terms of staff and computing facilities for both fitting and solving the model. Such resources may

not be available. The present project was subject to both of these limiting factors. It was accordingly necessary to plan and design a model for which data could be obtained, and which was also manageable computationally by the author and the resources available to him.

Keeping these limitations in mind, a model was designed which would attempt to explain at least the following flows, stocks, ratios, rates and measures.

Demand for Final Goods.

Consumption goods	– private
	– public
Investment goods	– private
	– public
Goods of foreign trade	– exports
	– imports

Supply of Final Goods. For the growth model supply will be treated as equal to the production of all final goods for civilian and military use.

Stock of Capital Goods. We shall want to explain the growth of this stock, and also display its function as a factor of production.

Employment and Unemployment. We shall want the model to show how the interaction of the forces of demand and supply determines the level of employment and unemployment.

Growth Measures. We shall want the model to reveal to us the growth rates in the important outcomes of the economic process – important from the point of view of economic strength and welfare. Among such outcomes we would include the total output available to residents (GNP), consumption, private and public (C and Cg), our estimate of standard of living ($C^n/N = c^n$), and the average real output per man-hour of labour (p_L). The latter two measures will of course represent our main indicators of vertical growth.

4. Further Considerations in the Plan of the Model

First let us consider the role of government in the model. In a short-run analysis government spending and tax rates would be treated as exogenous. But in the long-range growth model we consider government as very much a part of the economy and the society. Through government we consume goods collectively. Government acts as a co-ordinator of both society and economy. Government produces many services for the society, especially where such services yield considerable external economies. In doing all of these things government finds it necessary to invest in extensive capital goods – buildings, equipment, machinery, roads, bridges, other construction works. Government is accordingly something like a collective consumer, and something akin to a business firm.

For these reasons we treat the government sector in the growth model as endogenous – except for defence spending. This is still subject to international political developments of an exogenous nature, and we shall still treat it so, and hence project it independently.

Next let us consider the matter of bringing a price level, and the system of money and finance into the model. The use of a price level enables a model to function in both real and money terms. But it does complicate the model and increase its size, without producing long range money values that are likely to be very meaningful. In the interests of economy and manageability, it was decided to keep the model strictly in real terms, in constant dollars of 1957. An attempt was made, however, to bring the system of money and finance into the model in a limited way, so that the real balance or "Pigou" effect of financial assets on households and firms could be taken into account. It was hoped to be able to relate these balances to government deficits. This aspect of the inquiry, however, proved to be too ambitious; the data that could be pieced together for this purpose, within the author's limited resources, proved to be inadequate for the task.

The model as designed so far, and as seen in more detail later, may seem to be short on equilibrating mechanisms. As it stands there are only two such mechanisms in the system. One is that aggregate markets are brought into equilibrium within the period of one year. Thus aggregate supply is equated to aggregate demand, and there is no undesired accumulation or running down of inventories from year to year. Another is that real hourly earnings are kept in close alignment with average productivity relative to labour. There are however many equilibrating mechanisms in the real world, and it may be felt that the growth model should contain some of these to keep it from projecting unreal situations.

In the real world a high level of unemployment is supposed to exert a downward influence on wage rates which in the long run, so it has been suggested, should exert an influence towards moving again to higher levels of employment. The interest rate is supposed to exert some influence on saving and investing, which would tend to help bring these into equality at full employment. The price level effect on real balances of liquid assets is supposed to help restore full employment. The exchange rate and the international reserves are supposed to correct any lack of balance in foreign trade and finance. Government deficits and the size of the public debt are assumed to exert pressure on governments through public opinion, and ultimately through actual generation of inflation, to cause them to try to equilibrate their spending with their revenues.

While some of these mechanisms may be more effective than others, economic history has demonstrated that none of them work fast enough or painlessly enough to be relied upon to automatically adjust the economy to an optimal state. This is partly because of price and wage rigidities in the system, partly because income and liquidity effects are generally much more dominant forces in the economy than are price effects.

Since the automatic equilibrating mechanisms have been found wanting – and there is all too ample historical evidence of this – it is now taken for granted in the modern economy that government must step in and do the equilibrating for the society, as quickly, as consistently and as painlessly as possible. Hence, while it would be advantageous to include all of these mechanisms in a short-run model designed to help with government policy, their usefulness in a long-range growth model appears to be marginal. They would make the model much larger and more cumbersome. And since they would not likely produce full-employment equilibrium in any reasonable time, so that government intervention would become necessary anyhow, they would not give us any truer picture of the future.

The growth model for the present study does contain what are believed to be the main equilibrating forces of the modern economy, the spending – income – spending flows. Hence it will be left to run forward in time under the influence of these forces, and possibly with varying degrees of "government" intervention and policy, if and when these are found to be needed.

Through leaving the labour market adjustment process out of the growth model, we again part company in a further important way from what would be done in a short-run model. The short-run model would contain a demand for labour equation, a supply of labour (possibly treated as exogenous) and a labour market adjustment process, or short-run labour supply equation [91]. Since we are bypassing this short-run mechanism, we are apparently left without any way of expressing the demand for labour.

It turns out that the production function comes to our rescue in this problem. It shows the inputs of labour and capital needed to produce aggregate supply. The latter is equated to demand, with a boundary limitation represented be ceiling output at maximum feasible employment. The stock of capital is determined by the demand for new capital in the model, in conjunction with the previous stock and depreciation. Then the equation of supply and demand determines the amount of labour needed in the production function to produce the required supply.

Thus in our growth model the production function plays a dual role – it is the producer of supply, and at the same time it serves to create an implicit demand for labour.

5. A Detailed Design of the Growth Model

We must now move from the broad outline suggested above to a consideration of the detailed equations of the model. Each equation will be set out as a hypothesis, or sometimes as alternative hypotheses, to be tested. Each hypothesis will then be tested with the basic historical data assembled in this study. Some hypotheses can be expected to have various of the causal variables in them eliminated by the tests (Appendix C). Out of the tests that equation is selected which best represents the particular behaviour the equation is designed

to explain. All of the equations so selected will then have their parameters measured (if possible) by a simultaneous estimation technique (Appendix C). These measured equations will go into the final econometric model.

The equations designed for the model are now listed. The variable to be explained by each equation is put on the left side of a colon, while the set of assumed explanatory or directly causal variables is strung out on the right hand side of the same colon. The equations so set out can be looked upon as hypotheses to be tested.

All variables are in real or physical volume terms, or are expressed as ratios or percentages. Spending and income flows and stocks of capital are all in constant 1957 dollars. Flows are annual flows; stocks are at mid-year (June 30) unless otherwise specified; employment data are annual averages.

DETAILED PLAN OF GROWTH MODEL

I. DEMAND FOR FINAL GOODS

A. Consumption

Private Sector Household and Personal Consumption

1. C : $Y, C_{-1}, L_{hr-1}, N, u_1$

Y = Private sector disposable income, including undistributed corporation and wheat board profits and capital gains on inventories.

C_{-1} = Consumption expenditures of previous year [89].

L_{hr} = Real value (purchasing power) of liquid asset holdings of households and personal sector at end of year (December 31), and includes currency, chartered bank deposits, and securities of the three levels of government.

N = Total Canadian population, including the Yukon and Northwest Territories (YNT).

u_1 = The random or stochastic component of equation 1. It represents the aggregate effects of minor omitted variables, plus any non-systematic, capricious or inherently random behaviour of individual consumers. All major systematic behaviour is assumed to be accounted for by the preceding causal variables.

Public or Government Consumption

2. C_g : GDP_1, GDP_2, u_2.

C_g = All government expenditures, other than for fixed capital or military and defence needs: represents collective use of current resources for government, for the provision of civilian goods

or services with major external economies, and for the production of goods which might otherwise be produced under conditions of monopoly.

GDP = Gross domestic product = value of all goods produced within the geographical boundaries of Canada.

GDP_1 = GDP values 1927–1941, 1946–1953 inclusive, zero for 1954–1961.

GDP_2 = Zero to 1953, GDP values 1954–1961 inclusive.

Graphical analysis indicated a change in the relationship of C_g to GDP beginning in 1954.

B. Investment

Government Gross Investment in Fixed Capital (Non-military)

3. GI_g : ΔC_g, N, u_3.

ΔC_{gt} = $C_{gt} - C_{g,t-1}$. This term tests for an acceleration effect.

Private Gross Investment in Fixed Capital

(Dwellings, plant, construction, machinery and equipment.)

4. GI_{dPCM} : $(\pi + D)_{-1}$, ΔGDP, $K^n_{dPCM,-1}$, $L_{fr,-1}$, w_{hr}, $GI_{dPCM,-1}$, u_4.

π = Total non-wage or property-enterprise net income in GNP, including capital gains on inventories.

D = Capital consumption allowances and miscellaneous valuation adjustments in the National Accounts.

$\pi + D$ = Gross property-enterprise income.

K^n_{dPCM} = Total national stock (private and government) of fixed capital. (Private sector stock would have been better for this equation, but only the national stock was constructed for this model.)

L_{fr} = Real value of liquid asset holdings of business firms and institutions at end of year (December 31).

w_{hr} = Average hourly earnings of all civilian wage and salary earners in real terms; deflated by price index of net national product[1] to reflect purchasing power.

Private Sector Demand for Inventory Stocks

5. H_j : GDP, t, u_5.

H_j = Approximate June 30 or annual average stocks of agricultural and non-agricultural business inventories.

[1] See P in Appendix A, Table B–1, and in Appendix B.

H = December 31 or year-end stock of the same inventories.

H_j = $\frac{1}{2}(H + H_{-1})$, by definition, to enable conversion.

t = Time from 1926 origin = calendar year – 1926, ranging from 0 in 1926 to 35 in 1961.

C. Foreign Trade

Exports of goods and services, excluding interest and dividends received from abroad (π_{id}).

$F_2 : t.$

Imports of goods and services, excluding interest and dividends paid abroad (π_{di}).

6. F_1 : GDP, GI^n_{dPCM}, ΔH, N_u, $(3.5 - N^o_u) \underset{o}{+}$ or, u_6,

$GI^n_{dPCM} = GI_{dPCM} + GI_g$.

$\Delta H_t = H_t - H_{t-1}$ = inventory investment during year t.

N_u = Number unemployed (annual average).

$(3.5 - N^o_u) \underset{o}{+}$ or = Number of percentage points by which unemployment as a percentage of the civilian labour force ($N_1 - N_M = N_{1-M}$) is less than 3.5 per cent. Negative values are taken as zero.

II. SUPPLY OF FINAL GOODS

D. Combined Production Function and Implied Demand for Labour

7. GDP^s_c : A, N_eh, K_p, u_7.

GDP^s_c = Gross domestic product produced for supply by the civilian part of the economy.

A = Technical progress factor, or total productivity of the labour-capital team.[1]

N_e = N_{peg} = number of employed paid workers, entrepreneurs, own accounts, unpaid family workers, and government civilian employees.

h = Average number of hours of work per worker per year, allowing for part-time and short-time work, vacations and public holidays.

K_p = Real capital in productive use = stock of inventories plus stock of fixed capital adjusted for degree of unemployment of labour. (See equation No. 25 in econometric model below.)

7a. GDP^s_c : N_eh, K_p, t, u_{7a} (an alternative hypothesis).

---

[1] An accordance with the theory developed toward the end of Chapter 2, A should be explained as an endogenous variable, to close our growth theory. This has not been attempted in the present model.

III. MISCELLANEOUS EQUATIONS NEEDED TO COMPLETE THE MODEL

Depreciation – fixed Capital

(a) Accounting Values etc., Aggregated in National Accounts
(as defined above)

8. $D \quad : \text{GDP}, K^{n}_{dPCM,-1}, u_8.$

(b) Estimate of Real Depreciation on National Fixed Capital

9. $D^{n}_{r} \quad : K^{n}_{dPCM,-1}, t, u_9.$

The time trend in this hypothesis allows for changing composition of the stock, for example any increase in the proportion of machinery and equipment in the total. It could also allow for changing life expectancies of fixed capital.

Average Hourly Earnings in Real Terms

10. $w_{hr} \quad : p_{L,-1}, N^{o}_{u}, u_{10}.$

p_L = Average real output per unit of labour input (civilian) = $\text{GDP}_c/N_e h$.

In this hypothesis we attempt to relate real wages to the marginal productivity of labour (using average productivity as a surrogate) and to excess supply in the labour market. But we are only trying to get at the long-term relationship. (Cf., [91] for a more detailed and short-run analysis of the labour market.)

Average Hours of Work Per Worker Per Year

11. $h \quad : p_{L,-1}, N^{o}_{u}, t, u_{11}.$

In this relationship we test the hypotheses that hours of work are related to the trend of economic development, and also to the business cycle. The first hypothesis is that as the average output per hour of work rises, workers will take part of the increased productivity in more leisure, part in higher standard of living (cf., Chapter 6, Chart 6–6). The second hypothesis is that as business activity slows down, firms attempt to keep their skilled and trained employees on strength, but at reduced hours of work. Then when business picks up they do not incur the costs of re-hiring and re-training for the skilled jobs. Conversely when business is at the top of an upswing, moving into a boom, firms prefer to use their existing factors for increased or overtime hours, to save the costs of hiring and training extra workers for only a temporary period. They also do this to save the costs of installing extra equipment for just the peak periods.

The time variable t is put into this hypothesis to see if there is any further trend variation in hours over and above that explained by the productivity variable.

Indirect Taxes Less Subsidies

12. $T_{i-s} : \text{GDP}, t, u_{12}.$

Here we test the hypothesis that indirect taxes less subsidies are directly related to the flow of GDP, but may also have a time trend. If governments have been finding it increasingly necessary to use more indirect taxes, to avoid increasing direct tax rates to disincentive levels, then this trend will be found to be significant, and positive.

Government Disposable Income

13. Y_g : GDP, N_u, N_u^o, u_{13}.

Y_g = Aggregate revenue raised by three levels of government, less transfer payments to the private sector.

This equation attempts to bring into one aggregation all of the vast detail of government revenue and transfer payments. There needs to be much more experimentation with this relationship, testing as causal variables government spending G, and the separation of GDP into GDP_1 and GDP_2. The use of G as a causal variable would imply the hypothesis that government spends to meet social and political needs, and then must obtain the revenue to pay for its spending programme. However, the equation as postulated above, can be used directly in this sense as an equilibrating mechanism since government policy can change the values of the parameters of this equation.

Since government revenue and transfer payments are both sensitive to the state of economic activity, varying in opposite directions, Y_g should be doubly sensitive to the business cycle. We test this relationship by using N_u or N_u^o as a further indicator of the cycle in addition to GDP. Net flows of unemployment insurance are contained in Y_g, and are of course closely related to N_u.

IV. IDENTITIES

In order to complete and close the system of equations there are certain identity relations which exist among the variables and which must accordingly be represented in the model. Examples of these are as follows:

1. In the long run aggregate demand equals aggregate production for supply, subject to the boundary condition of the production ceiling. In the short run there are of course inventory cycles.
2. Aggregate income or costs equals the aggregate value of output.
3. Unemployment equals the civilian labour force minus the number of civilian employed.
4. The stock of capital in the current year equals the stock in the previous year plus new gross investment less real depreciation.

There is quite a large number of these identities in the complete model, and to economize space they are stated only once. The logical place to set them out in detail is the econometric model itself, to which we now turn.

6. The Econometric Growth Model

We arrive at the econometric model by testing the above hypotheses in the linear equation forms, using the historical statistical data of Appendix A. For

any particular relationship we tentatively accept that hypothesis which produces the best statistical fit, combined with parameter values which seem most reasonable on the basis of general observation and economic theory. We expect parameter estimates to be statistically significant (based on t-tests), parameter values to have appropriate sizes and signs, and the residual u_i to be free of any systematic behaviour.

At the completion of testing, the form and content of each equation to appear in the final model is decided upon. The complete model is then estimated simultaneously (in concept) by appropriate statistical procedures (Appendix C).

In testing and fitting the model with the data, the main war years were omitted, because in many areas the patterns of economic behaviour were drastically altered in these years. One of the assumptions in estimation, of course, is that the structure of behaviour being estimated, including the distribution of the random term, remains constant. The data for 1926 were needed to provide the lags affecting 1927, and as a result the first year's behaviour which the model can explain is 1927. Accordingly the years of observed data which our model attempts to explain are 1927–1941, 1946–1961 inclusive. This gives us 31 years of observed data with which to fit the theoretical behaviour of the macro economy.

The units of measure used in the model are as follows:

(a) All value flows and stocks are in billions of 1957 dollars.

(b) Flows represent the aggregate flow for one calendar year. Stocks are estimated as at mid-year, June 30. For inventory stocks however, H_{jt} is meant to be at June 30, but is in fact determined from the definition given above. H_t is at year-end, December 31, of year t.

(c) Population and labour force data in millions of people.

(d) Population is positioned at the Census date of June 1. Labour force, employment and unemployment are (in principle) an annual average of 12 months.

(e) Average hours of work per year are in units of 1,000 hours.

(f) Real average hourly earnings are in units of one constant dollar of 1957.

(g) Productivity relative to labour is in units of one 1957 dollar per man-hour.

(h) The rate of unemployment N_u^o is in units of one per cent.

The parameters in the econometric model below were obtained from the electronic computer printout sheets to six digits and decimal points, whenever this many digits were available. The basic data however contained predominantly four and five significant figures (SF). Hence we are only justified in quoting three SF in our resulting parameter estimates. The reason for carrying all extra digits available up to six, and six decimal points, was that the model was to be used for extensive computations to derive Projection No. 3. The extra digits are then carried to keep the rounding errors of these computations a sufficient distance away from our three good SF.

The econometric model is now presented. The explanation of the statistics of "goodness of fit" accompanying the model will be found in Appendix C.

AN ECONOMETRIC GROWTH MODEL OF CANADA

	Method of Estimation	Goodness of Explanation T = 31		
		V %	R	δ^2/s^2
I. DEMAND FOR FINAL GOODS				
A. Consumption				
Private Sector Household and Personal Consumption				
1. $C = .355{,}829Y + .250{,}711N + .485{,}050C_{-1} - 1.371{,}265$	TL	1.8	.999	1.88
(6.6) (2.6) (5.5)				
Public or Government Consumption				
2. $C_g = .0487478GDP_1 + .0789585GDP_2 + .383{,}787$	TL	13.3	.965	.847
(5.7) (16.8)				
B. Investment				
Government Gross Investment in Fixed Capital (Non-military)				
3. $GI_g = .158{,}744N - 1.415{,}862$	TL	23.3	.945	N.A.
(15.5)	LS			
Private Gross Investment in Fixed Capital				
4. $GI_{dPCM} = .135{,}794\,\Delta\,GDP + .248{,}011\,(\pi + D)_{-1} + .616{,}650GI_{dPCM,-1} - .536{,}716$	TL	9.0	.991	1.06
(1.5) (4.3) (7.3)				
Private Sector Demand for Inventory Stocks				
5. $H_j = -.044t + .36187GDP + 1.6217$	SWLS	7.2	.977	N.A.
(1.2) (7.9)				

AN ECONOMETRIC GROWTH MODEL OF CANADA (Cont'd)

	Method of Estimation	Goodness of Explanation T = 31		
		V %	R	δ^2/S^2
I. DEMAND FOR FINAL GOODS (Concl.)				
C. Foreign Trade				
Exports (goods and services, excluding interest and dividends received from abroad)				
$F_{2t} = F_{2,\,1961}\,(1.03)^t$: An exogenous growth equation with t = calendar year − 1961.				
Imports (goods and services, excluding interest and dividends paid abroad)				
6. $F_1 = .155{,}885GDP + .241{,}471\,(3.5 - N_u^o)\,{}^{+}_{0}{}^{or} + .178{,}616\,\Delta H$ (9.4) (2.3) (2.1)				
$-.348{,}942N_u + .256{,}350GI^n_{dPCM} + .0433676$ (1.8) (4.6)	LS	3.9	.998	N.A.
II. SUPPLY OF FINAL GOODS				
D. Combined Production Function and Implied Demand for Labour				
7. $\frac{GDP^s_c}{A} = 1.084{,}027N_e h + .111{,}949K_p - 5.596{,}308$ (8.4) (13.0) (5.0)	TL	3.2	.992	.723
III. MISCELLANEOUS EQUATIONS TO HELP COMPLETE MODEL				
Depreciation – Fixed Capital				
(a) Accounting Values etc., Aggregated in National Accounts				
8. $D = .0702889GDP + .0294291\,K^n_{dPCM,-1} - .684{,}650$ (11.9) (8.1)	TL	6.5	.989	.808

AN ECONOMETRIC GROWTH MODEL OF CANADA (Cont'd)

	Method of Estimation	Goodness of Explanation T = 31		
		V_{pc}	R	δ^2/S^2
III. MISCELLANEOUS EQUATIONS TO HELP COMPLETE MODEL (Concl.)				
(b) Estimate of Real Depreciation				
9. $D_r^n = .05671\ K_{dPCM,-1}^n + .0027067t - .4179$ $(139.1)\qquad(5.2)$	SWLS	0.8	.999	N.A.
Average Hourly Earnings in Real Terms				
10. $w_{hr} = .50505\ p_{L,-1} + .35029$ (35.3)	SWLS	3.8	.989	N.A.
Average Hours of Work Per Worker Per Year				
11. $h = -.0082595t - .2550\ p_{L,-1} - .0066487N_u^o + 3.1107$ $(1.8)\qquad(2.8)\qquad(2.5)$	SWLS	2.7	.955	N.A.
Indirect Taxes Less Subsidies				
12. $T_{i-s} = .017t + .09745\ GDP + .1009$ $(2.0)\qquad(9.3)$	SWLS	5.6	.992	N.A.
Government Disposable Income				
13. $Y_g = .210{,}813\ GDP - .693{,}238\ N_u - .927{,}618$ $(26.5)\qquad(2.3)\qquad(2.21)$	TL	11.5	.983	1.33

AN ECONOMETRIC GROWTH MODEL OF CANADA (Cont'd)

IV. IDENTITIES

Aggregate Demand for Final Goods (Combining with Supply to Determine Employment)

14. $C + C_g + G_M + GI_g + GI_{dPCM} + H - H_{-1} + F_2 - \frac{1}{2}R_2 = GDP_c^d + G_{M1} + F_1{}^d$

G_M = Total government spending for defence (military) needs.

$-\frac{1}{2}R_2$ = Residual error of estimate in GNE, the expenditure side of the national accounts (GNE = GNP).

G_{M1} = Value added to GDP by armed forces, and equals military pay and allowances.

14. (a) $GDP_c^d = GDP_c^s$ in equilibrium.

15. $H - H_{-1} = 2(H_j - H_{j-1}) - (H_{-1} - H_{-2})$

Employment and Unemployment

16. $N_u = (N_1 - N_M) - N_e$

N_M = Numbers in armed forces; $N_1 - N_M$ = civilian labour force.

17. $N_u^o = \dfrac{(N_u)}{(N_1 - N_M)} \times 100$ = percentage unemployment of civilian labour force.

Gross Domestic Product and Gross National Product

18. $GDP = GDP_c + G_{M1}$

19. $GNP = GDP + \pi_{id} - \pi_{di}$

Disposable Private Sector Net Income

20. $Y = GNP + J - Y_g - D - \frac{1}{2}R_1$

J = capital gains on inventories = negative of inventory valuation adjustment.

$\frac{1}{2}R_1$ = residual error of estimate in GNP.

Civilian Wage Bill

21. $W_c = w_{hr}h \ (N_e - N_{enp})$

N_{enp} = Number of own account workers, employers and unpaid family workers.

AN ECONOMETRIC GROWTH MODEL OF CANADA (Cont'd)

IV. IDENTITIES (Cont'd)

Property-Enterprise or Non-Wage Income (Net of Depreciation Allowances)

22. $\pi = GNP + J - W_c - W_M - D - T_{i-s} - \frac{1}{2}R_1$

W_M = purchasing power of military pay and allowances $= W_{Mm}/P$.

Stock of National Fixed Capital

23. $K^n_{dPCM} = K^n_{dPCM,-1} + GI^n_{dPCM} - D^n_r$

Stocks are at mid-year, and flows are assumed to have an average dating at mid-year.

24. $GI^n_{dPCM} = GI_g + GI_{dPCM}$

Capital in Use in Production

25. $K_p = H_j + K^n_{dPCM} \left[\frac{100.0 - (N^o_u - 2.0)}{100} \; \begin{matrix} + \text{ or} \\ \text{zero} \end{matrix} \right]$

The assumption is made that at two per cent or less unemployment, capital capacity is being fully used, but when unemployment rises above two per cent unused capacity appears.

Average Productivity Relative to Labour

26. $P_L = GDP_c / N_e h$

Government Surplus or Deficit (Saving)

27. $S_g = Y_g - (C_g + GI_g + G_M)$

Current Account Surplus (Deficit) = Net Capital Outflow (Inflow) = Savings Invested Internationally (Foreign Savings Flow into Domestic Investment)

28. $S_F = F_2 + \pi_{id} - F_1 - \pi_{di}$

National Saving

29. $S^n = GNP - C - C_g - G_M$

$= (GI_g + GI_{dPCM} + \Delta H) + S_F - \frac{1}{2}R_2$

AN ECONOMETRIC GROWTH MODEL OF CANADA (Concl.)

IV. IDENTITIES (Concl.)

The Endogenous Variables in this Model are: C, Y, C_g, GDP, GI_g, GI_{dPCM}, H_j, F_1, N_u^o, N_u, H, GI^n_{dPCM}, GDP_c, N_e, h, K_p, D, D^n_r, w_{hr}, T_{i-s}, Y_g, GNP, W_c, π, K^n_{dPCM}, p_L, S_g, S_F, S^n.

Number of Endogenous Variables: 29

The Predetermined Variables in this Model are:

(a) Exogenous: N, t, F_2, A, G_M, $-\frac{1}{2}R_2$, G_{M1}, W_M, N_1-N_M, π_{id}, π_{di}, J, $\frac{1}{2}R_1$, N_{enp}.

(b) Lagged: C_{-1}, GDP_{-1}, $(\pi + D)_{-1}$, $GI_{dPCM,-1}$, H_{-1}, $K^n_{dPCM,-1}$, $p_{L,-1}$, $H_{j,-1}$, H_{-2}.

Number of exogenous variables:	14
Number of lagged variables:	9
Number of predetermined variables:	23

Total Number of Variables in Growth Model: 52

Identification: Application of the elementary tests for the identification of the parameters in the above equations reveals that they are all very much over-identified. Hence there is no statistical problem to their simultaneous estimation. This condition is possibly enhanced by the non-linear identities.

Equilibrating Mechanisms: Foci of Policy

N_u, S_g, S_F.

7. Comments About the Econometric Model

As explained in Appendix C, all of the testing of alternative hypotheses which one would have liked to have done, to reduce imperfections as they appeared, was not possible in this limited project. This model is accordingly only a beginning in the development of econometric models of economic growth. With this caveat in mind, let us proceed to look at some of the individual equations.

Equation 1. The liquid asset (real balances) variable was eliminated in the tests. This was probably because the data were inadequate, but it may also have happened because liquid assets moved too closely parallel to some other variable (multicollinearity), or because this variable did not move extensively enough, except as between prewar and postwar to make its influence register. These possibilities are worth exploring once more adequate data are obtained. Also the influence of real balances may be better detected through cross-sectional and time series studies of family budgets.

This equation of private consumer demand is the best fitting major equation of the model. The habit persistence hypothesis [89] (C_{-1}) was again given strong statistical support; and both population and disposable income (especially the latter) were significant in explaining private consumer demand. We might have expected disposable income to include all of the effects of changing population, but this proved to be not the case.

Equation 2. This equation presents an interesting example of the handling of a nonlinearity, a change of slope or rate of influence of one variable on another. Our explanation of C_g does not appear to be complete, however, since the von Neumann ratio (δ^2/S^2) indicates the presence of further systematic influence on C_g. Our limited programme did not permit us to continue with the research necessary to discover what this influence might be.

Equation 3. The tests failed to show a significant acceleration effect. Further tests using GDP_1, GDP_2 and ΔGDP might provide new insights here.

Equation 4. The liquid asset (real balances) influence failed to register, probably for the same reasons as in equation 1. Real hourly earnings were expected to reveal a substitution effect to capital and away from labour, but this failed to appear, possibly because the test was too blunt. Perhaps we would need to compare in ratio form money wage rates with the price of capital goods, or with the cost of capital represented by the yield on bonds plus a sinking fund rate to replace capital depreciation (i + sf).

The acceleration effect did show up (ΔGDP) in this equation. Also the dynamic sequence of planning current investment on the basis of the gross

profits of the previous year revealed a strong influence. In addition there appears to be a strong carry-over influence of investment projects into the subsequent year, to which may be added a stimulation effect as investment in one period stimulates investment in the subsequent year, by a multiplier-accelerator sequence over and above the one already depicted.

Equation 5. The negative time trend suggests the possibility that improving communications and inventory management techniques will reduce the level of inventories needed relative to GDP. Also the gradual increase in the importance of services relative to goods may add to this influence.

Equation 6. In this equation the simultaneous estimates gave results which varied much more widely than usual from the least squares tests. At the same time they were not in agreement with previous simultaneous estimates in this area, or with general economic observation and theory. The LS results on the other hand were generally reasonable and in agreement with past results. It was believed that there was some defect in the simultaneous estimate, but there was no chance in the present project to find out what the trouble was. The LS results were accordingly used in the growth model.

The use of N_u in two forms in this equation was designed to test a possibly nonlinear relationship. The hypothesis is that as domestic excess capacity (represented by N_u) falls, imports increase, filling a larger proportion of the marginal demands. But once unemployment falls to 3.5 per cent of the civilian labour force and lower, bottlenecks in the economy became increasingly prevalent. The import flow now accelerates to satisfy domestic demands, and the relationship between imports and surplus capacity becomes steeper. Again a nonlinear relationship is described by linear techniques. A corner discontinuity occurs at $N_u^o = 3.5$ per cent.

The remaining terms in this equation reflect the import content of gross public and private investment in fixed capital, and of inventory investment. The GDP term reflects the inflow of imports of industrial materials and fuels into the domestic productive system, and also, along with ΔH, takes into account imports of consumer goods.

Equation 7. This equation gave very satisfactory results in harmony with general observation and economic theory. But the low value of δ^2/S^2 indicates the need for research to discover some small remaining systematic influence affecting the value of GDP_c/A. The marginal productivities of labour and capital seem to be appropriate in size, though if land used in production were added to the equation the marginal productivity of our reproducible capital would probably be estimated with a lower value.

The negative constant term in this equation is of economic significance. It suggests that the Canadian economy as a whole is subject to increasing returns to labour and capital, that we are still below the optimum proportionality

of labour and reproducible capital relative to our land and natural resources.[1] There is very likely some connection between this result and the ready willingness of other countries to invest capital in Canada.

Equation 10. While the rate of unemployment is an important explanatory variable for the current money value of average hourly earnings [91], this variable was rejected by the data as an influence on the real value. There is only a slight cyclical pattern in w_{hr}. While more research is needed on this equation, the simple result obtained fits fairly well.

Equation 13. This equation shows clearly how government disposable income is dependent on the health and vigour of the general economy. For each billion dollar increase in GDP approximately one-fifth or 200 million dollars will flow to government. But in addition, if this results in a reduction in unemployment of 230 thousand (rough estimate from equation 7), government disposable income will increase a further 160 million. Thus government may be able to pump-prime at little net cost, if only it finds the most efficient ways of doing it.

The negative constant term in this equation is also of considerable economic significance. For short-run analysis it means that, for moderate levels of unemployment, the elasticity of government disposable income with respect to GDP is greater than one.[2] This means that government revenues could be expected to respond copiously to vigorous growth, tending to turn the persistent defecits of slow growth into moderate surpluses.

To separate out the short-run behaviour and the long-term trend of this relationship in future research, an hypothesis of the form $Y_g = (a_1 + a_2 t)$ GDP $+ a_3 N_u + a_o$ should be tested.

8. Conclusion

With the above model we have tried to discover the direct or proximate rate of influence of each variable in the model on each other. When a variable does not occur in a particular equation, this means that its direct influence on the variable being explained is zero. The model will also tell us the final or ultimate influence of each variable in the system on each other but the rates must be found by solving the model for the endogenous, in terms of the predetermined variables. Such solution reveals how every variable in the model exerts an ultimate, indirect influence on all of the endogenous variables in the system.

[1] Let labour and capital inputs increase in fixed proportion to each other, and by a scale factor r. Then, we have $GDP_c = A(kr - 5.6)$. Now a 1 per cent increase in scale produces a percentage increase in output of $\frac{dGDP_c}{GDP_c} \Big/ \frac{dr}{r} = \frac{A\ K\ r}{A(Kr - 5.6)}$ pc, which is greater than 1 per cent because of the negative constant term, -5.6.

[2] $$\frac{\partial Y_g}{Y_g} \Big/ \frac{\partial GDP}{GDP} = \frac{.211 GDP}{.211 GDP - .693 N_u - .928}$$

The rates of influence so determined provide a complete set of the ultimate multipliers of the economic system as represented by the model. They show the total effect of a change anywhere in the system, after it has worked its way through the system in successive rounds, until a new equilibrium solution is obtained. It is these features of the model which make it a useful potential tool for assisting in the formulation of effective economic policy, to guide the economy toward desired goals. The form of the model will provide ideas about the kinds of policy that may be most appropriately considered. The model itself can then be used to calculate the immediate and the ultimate current effects of each policy alternative which is being considered. Effective policy can then be sought for by using criteria of maximizing benefits in relationship to costs.

Our immediate interest in this model of course is as an engine of economic projection. Subject to its many imperfections (which we hope future research and improved data will gradually reduce) we shall look to it to provide us with an analysis of the trends of future development of demand for final goods in the Canadian economy, as well as the concomitant development of trends of potential supply and capacity. Indeed it is the analysis of the demand side of the economy that is the special new feature of this more comprehensive model.

As we use the growth model for Projection No. 3 we shall hope to present some analysis of our problems of unemployment and imperfect growth, and offer some approaches to deal with these defects in our economic system as it now operates. To this third projection we now turn.

CHAPTER 10

PROJECTION NUMBER THREE

This is PR–3, the third and final projection of our study. Each of the projections has been based upon a simplified pattern or model of how the macro-economy works, and has been aimed especially at how it grows. Each of the models is a little more detailed, and hence a little more analytical than its predecessor.

This projection is derived from the econometric model which was outlined in the preceding chapter. It is much more detailed than the other models, and indeed is the first of the models which attempts to estimate the main *behaviour* relations of the macro-economy. Of special importance in this regard is that it is designed to explain and project demand, as well as supply. It will be recalled from our earlier discussion of theory of growth that expanding demand is as much more a *necessary* condition of growth, as is expanding potential supply. But neither by itself is *sufficient* to produce growth, especially vertical growth. In fact it is only when the two advance appropriately and in relation to each other that we get both the necessary and sufficient conditions for growth, especially for optimal growth.

It will be recalled that this model was built without any of the market equilibrating mechanisms of the economy (which in classical theory would have automatically adjusted the economy to high level employment), in order to keep it as small as possible, and to concentrate it solely on growth. It was assumed that the necessary equilibrations would have to be achieved by government policy – as indeed it largely is in the real world. (The mechanisms omitted include the money wage rates of the labour market, the prices of the goods market, the interest rates of the money and finance markets, and the exchange rates of the foreign exchange markets.)[1] There were however other kinds of adjusting or equilibrating systems in the model, some of which helped to maintain employment, but none of which could be expected, or depended upon, to accomplish this vital task. Global supply was brought into equality with global demand, with long-run adjustments in the stock of capital, brought about through investment; and through short-run

[1] Experience has shown that these mechanisms do not act with sufficient speed or strength, or even always in the right direction, to restore the economy to high employment equilibrium. There is room for abundant econometric research on the kind of assistance, as well as its speed and strength which these mechanisms do give to government policy aimed at high employment. For example, do reductions in wage rates stimulate employment on balance, or do they reduce it?

adjustments in labour input. The real wage rate was tied to the trend in vertical growth (real output per man-hour) thereby sustaining demand to some extent in parallel with supply. Finally the hours of work component of labour input was so constituted that it would cushion the effect on employment of excess demand for labour by increasing hours, and of excess supply of labour by reducing hours.

Despite the general lack of market equilibrating mechanisms, it was felt that it would be useful to carry out one projection with the model "running free" that is without any government interference or policy. The purpose of this was to try and see more clearly the underlying dynamic structure of the model from the points of view of growth and cycles. Cycles about a growth trend were rather expected, since the model contained many lagged relations as well as the stock of inventories, and the stock of durable capital goods.

It was next planned to carry out a more realistic projection with the model, in which any necessary adjustments to structure, plus government policy, would be applied to get the model on to a high employment growth path and to keep it there until 1991.

The methods and results of these two projections are now presented in sequence.

A. Free Projection – PR–3F

Predetermined Data

The first step in this projection was to prepare an independent projection of the exogenous variables which appear in the econometric growth model. In the main these variables were already available from the previous two projections. There, however, they were given only at five-year intervals, whereas for this projection they were needed annually. For since the econometric model was built from annualttime data, its lags and stocks could only be obtained for sequential solutions by solving the model year by year to 1991.

Interpolations from five-year to annual data were made using linear methods or annual growth rates, whichever seemed more appropriate. The methodes of projection or interpolation of the exogenous data are stated in Appendix B. The resulting table of the exogenous data used in the econometric projections is found as Table 3 in the Appendix to this Chapter. Two special points in this table can be mentioned here. On the basis of the historical trends of Canadian exports, and of a survey of statistics of world trade, exports of goods and services (F_2) were projected with an annual compound growth rate of 3.0 per cent (Col. 6). The long-term growth rate of technical progress was 1.7 per cent, and this was the rate used in the projection (Col. 4).

Method of Annual Solution

The procedure for the free projection was to insert the exogenous data for 1962 and the lagged data from 1961 applicable to 1962 into the model, and solve

it for the 1962 endogenous variables. The method of simultaneous solution is to assume that, at the solution, the value of a variable in any one equation is brought into equality with its value in all other equations of the system, so that the equations all "intersect". Then a *single set* of values of the endogenous variables satisfies *all* of the equations *simultaneously*. This is of the nature of a general equilibrium in economics.

To arrive at our simultaneous solution we used the method of continuous substitution to eliminate variables, until finally we reached an equation in only one variable. This variable in our case was N_e (total employment) and the final equation in N_e was quadratic. (Recall that the original model is non-linear, containing in it terms like $N_e h$). There were thus two solution values for N_e, but only one of these proved to have economic relevance, the other being negative. Having determined N_e it is then possible to compute each of the other endogenous variables in a "back solution" using the equations of the substitution-elimination process. A sequence of checks throughout the procedure guarded against errors. One such check was the summing of income components to obtain GNP, and of expenditure components to obtain GNE, followed by a check on the equality of GNP and GNE.

The solution for 1963 was then obtained by repeating this process, using the exogenous data for 1963, and the lagged values of the endogenous variables derived in the 1962 solution. This dynamic process was now carried on year by year as far as desired, thereby producing the free econometric projection PR–3F.

The whole algebraic procedure was programmed to a sequence of steps which were as streamlined and systematic as possible, and which facilitated repetition year after year.

Results Obtained from PR–3F

As the solutions got under way it was discovered almost immediately that the demand for inventory equation made the model unstable – gave it cyclical variation of widening amplitude. Had there been time to test the model in advance this would have been discovered and then through experimentation the parameters of this equation could have been varied, until it and the model produced a truer simulation of the economy. Since time for this research was not available, the only alternative was to delete the demand for inventory equation from the model and treat inventory investment as exogenous. Essentially the values worked out for PR–2 were used. This gave the growth needs for inventory investment, and deleted the inventory cycle, giving us the longer term trends in the economy.

Once the model had been so revised, the projection proceeded smoothly on a fairly stable growth path. This path proved to be a very interesting one, but it had one major shortcoming which it would clearly be necessary to revise in the controlled projection. The hours of work equation was linear, and hours moved inexorably downward by constant amounts per unit increases in time, labour productivity and per cent unemployed. Since all of these increased continuously in the projection,

hours of work eventually became impossibly low. Some form of percentage or exponential, rather than linear decline, should have been used in this equation. This equation would clearly have to be adjusted for the controlled projection. The sensitive areas in our model, from the point of view of the healthy functioning of the economy, are the rate of unemployment N_u^o; the current account balance on international trade S_F (taking into account the circumstances surrounding it); and the government surplus or deficit S_g. These cannot be allowed to get too far out of line before government must act to restore them to a safe and proper margin. The most important of these areas from a welfare point of view is N_u^o, and we have previously suggested that we have a high level of employment when this rate is between 2 and 4 per cent. No such specific formulas have been attempted for the other two areas, and judgement based on individual circumstances must be used to decide when these are out of control or out of line. How did these sensitive areas fare in the free projection?

The proportion of unemployment N_u^o increased steadily in this projection from 1962 to 1975, when it reached 13.6 per cent. In 1976 this proportion started to fall but the hours by that time had become much too low – 25 hours per week – and were falling fast. Hence it was felt that there was no point in recording this projection beyond 1976. With regard to the foreign account balance, the trends of the past decade continued. The deficit grew from 724 million 1957 dollars in 1961 to 2,543 million in 1976. The government accounts surprisingly switched to a surplus in this projection in 1962, and continued in moderate surplus until 1976. Government disposable income in the projection grew at a slightly faster rate than total government spending.

Let us now examine the detail of the projection, to see how these results came about. The values of the main variables in PR–3F at five-year intervals are set out in Table 1F. Along with these are shown the annual compound growth rates of these variables over each five-year period, and finally over the total period of the projection.

From Table 1F we can sort out the picture of a simulation of the growing Canadian economy, running free. We know in advance that our model has weaknesses, and some of these have been discussed. But it was fitted to the observed Canadian data, and hence some of the trends it portrays when it is running free may indicate the major areas toward which policy in the future must be directed. In fact the trends are rather remarkable for a free enterprise economy, and are distinctly "unclassical". Yet they are something like the situation and trends we have seen in Canada in the last decade. They reveal a steady and "prosperous" growth at around three and one-half per cent per annum, but with serious and growing unemployment. This unemployment in only arrested finally in the model by the rapid fall in hours of work. This decline is partly caused by the unemployment (cf. Chapter 9), and is one of the adjusting mechanisms of the model, tending to restore high employment. By 1976 it was beginning to make itself felt, and by 1981 it had overdone it.

How could the economy reasonably grow in "prosperity", with unemployment continually increasing up to as high as 13 per cent? The answer seems to be

found mainly in the insulation of the labour market from the unemployed, so that real wage rates do not fall, but instead advance. In the real world this kind of situation has indeed gradually evolved, through the general resistance to reduce wage rates, and also with the growing strength of the trade unions. In our growth model real wages are influenced only by productivity, and this productivity grows. It increases because of technical progress, and as long as there is sufficient total demand.

Aggregate demand is sustained in this model by exogenous forces in the form of a fairly high growth rate of population (two and one-quarter per cent), and of steady growth rate of exports (three per cent). On the endogenous side a strong sustaining factor is the real wage rate. It advances at three and three-quarter per cent, while man-hours employed falls at only one and one-half per cent. Consequently the civilian wage bill grows at a rate of appropriately two and one-half per cent. This is at a sufficient rate to sustain consumption at a strong rate of growth, so that profits and investment are buoyant.

While this is taking place the hours of work per worker drop at rate three and one-third per cent. This permits employment to advance at two per cent. But the changes in the civilian labour force in this period are as follows: 1961–66: two and one-half per cent; 1966–71: two and one-quarter per cent; 1971–76: two and one-quarter per cent; 1961–76: two and one-half per cent. Thus the labour force continuously grew faster than employment.

The real wage rate grows rapidly because average labour productivity advances at a rate of five per cent. This high rate is due to technical progress, increasing returns to scale, and a rapid growth of capital. Operating on the basis of the acceleration principle and growth in profits, the capital stock grows at nearly four and one-quarter per cent. This of course helps to displace labour, and at the same time increases rapidly the productivity of the labour that is left in production. This displacement is revealed dramatically by the fact that labour input in man-hours actually declines, at a negative growth rate of one and one-half per cent.

Given the steady growth in demand, technical progress, the rapid growth of the stock of capital and the real wage bill growing at only two and one-half per cent, the income of property and enterprise fares well. It grows at 4.7 per cent. The average rate of return relative to reproducible capital, π/K, was 7.9 per cent in 1961, but by 1976 it had become 8.5 per cent. Both capital/labour and the capital/output ratios increase as the technology and the economy substitute capital for labour.

Under the stimulus of this steady growth, government disposable income grows faster (four per cent) than total government spending on consumption, defence and investment (3.1 per cent). The government disposable income equation in the model has a high elasticity relative to income. As a result the deficit of 698 million dollars in 1961 has become a surplus of 143 million by 1976.

TABLE 1F

THE FREE PROJECTION – PR–3F

MAIN ENDOGENOUS VARIABLES FROM ECONOMETRIC MODEL SOLUTIONS

	1	2	3	4	5	6	7	8	9	10	11
									Government Expenditures		
Years	Wages and Salaries -Civilian	Income of Property and Enterprise	Indirect Taxes Less Subsidies	Capital Consumption Allowances	Private Sector Disposable Income	Government Disposable Income	Gross National Product	Consumer Expenditures	Consumption	Investment	Total (incl. G_M)
Symbol	W_c	π	T_{i-s}	D	Y	Y_g	GNP	C	C_g	GI_g	G
Units	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$
1961	17,742	8,034	4,362	4,012	24,745	5,910	34,529	22,859	3,486	1,670	6,608
1966	19,962	10,205	4,832	5,285	28,264	7,312	40,862	25,999	3,667	1,806	7,268
g	2.4	4.9	2.1	5.7	2.7	4.3	3.4	2.6	1.0	1.6	1.9
1971	22,964	12,755	5,684	6,542	33,302	8,748	48,592	30,458	4,287	2,170	8,715
g	2.8	4.6	3.3	4.4	3.3	3.6	3.5	3.2	3.2	3.7	3.7
1976	25,990	16,070	6,653	8,085	38,883	10,548	57,516	35,507	5,004	2,590	10,405
g	2.5	4.7	3.2	4.3	3.1	3.8	3.5	3.1	3.1	3.8	3.6
tg	2.6	4.7	2.9	4.8	3.1	3.9	3.5	3.0	2.3	3.0	3.1

TABLE 1F (Cont'd.)

	12	13	14	15	16	17	18	19	20	21	22
Year	Business Gross Fixed Capital Formation	Exports of Goods and Services	Imports of Goods and Services	Employment	Unemployment	Unemployment as % of Civilian Labour Force	Hours of Work	Labour Input-Man-Hours	Real Output Per Man-Hour	Real Wage Rate	National Stock of Reproducible Real Capital
Symbol	GI_{dPCM}	F_2'	F_1'	$N_e\left(\begin{matrix}\text{ann.}\\\text{aver.}\end{matrix}\right)$	$N_u\left(\begin{matrix}\text{ann.}\\\text{aver.}\end{matrix}\right)$	$N_u^c\left(\begin{matrix}\text{ann.}\\\text{aver.}\end{matrix}\right)$	$h\,\begin{matrix}\text{per}\\\text{yr.}\end{matrix}$	$L=N_eh$	p_L	w_{hr}	K
Units	m–57$	m–57$	m–57$	t	t	%	1hr.	m m–h	one 57$ per m–h	one 57$	m–57$
1961	5,990	7,343	8,067	6,060	469	7.2	2,164	13,114	2.640	1.667	102,050
1966	8,028	8,705	9,847	6,595	757	10.3	1,916	12,638	3.247	1.926	123,387
g	6.0	3.5	4.1	1.7			–2.4	– .7	4.2	2.9	3.9
1971	10,338	10,113	11,859	7,220	1,078	13.0	1,667	12,033	4.059	2.303	152,447
g	5.2	3.0	3.8	1.8			–2.7	–1.0	4.6	3.6	4.3
1976	13,184	11,749	14,292	8,062	1,239	13.3	1,306	10,530	5.493	2,931	189,211
g	5.0	3.0	3.8	2.2			–4.8	–2.6	6.2	4.9	4.4
tg	5.4	3.2	3.9	1.9			–3.3	–1.5	5.0	3.8	4.2

TABLE 1F (Concl.)

Year	23 Capital/ Labour Ratio	24 Capital/ Output Ratio	25 Saving–Investment Ratio (Re-Production and Growth)	26 National Saving Ratio	27 Government Surplus on National Accounts Definition	28 Balance of Payment Surplus on Current Account	29 Standard of Living or National Consumption Per Capita
Symbol	K/L	$K/GDP_c = k$	s × 100	S^{no}	S_g	S_F	c^n
Units	57$ per m–h	r	%	%	m–57$	m–57$	one–57$
1961	7.782	2.948	21.1	19.5	–698	–724	1,444.5
1966	9.763	3.006	25.4	23.0	44	–1,182	1,461.6
g							0.2
1971	12.669	3.121	27.0	23.9	33	–1,746	1,538.1
g							1.0
1976	17.969	3.271	28.6	24.7	143	–2,543	1,605.4
g							.9
tg							.7

Notes to Table

1. GNP can be built up from the income components by adding columns 1, 2, 3, 4, plus W_M from Table 3 Exogenous Data in Appendix in this chapter; and by adding columns 4, 5 and 6. For 1961 we must also deduct J and add ½ R_1. In the years projected with the model these values are zero. Perfect equalities may not always be obtained, because of rounding errors.
2. GNE = GNP can be built up from the expenditure components by adding columns 8, 11, 12, 13, –14, plus ΔH from Table 3 in Appendix. For 1961 we must also add $-\frac{1}{2}R_2$.
3. $G = C_g + G_M + GI_g$. G_M is found in Table 3, Exogenous Data.
4. $s = (\Delta H + GI^n_{dPCM}) / GDP = GI^n / GDP$.
5. $S^{no} = 100\ (GNE - C - C_g - C_M)\ /\ GNE$.
6. $S_g = Y_g - G$; $S_F = F_2' - F_1'$; $c^n = \dfrac{C + C_g}{N} = \dfrac{C^n}{N}$.
7. g = compound annual growth rate over previous five years, as per cent.
   tg = compound annual growth rate over total period from 1961 to terminal date of projection, as per cent.

In the field of foreign trade, imports grow at a rate of nearly 4 per cent, while exports have a rate of only 3 per cent. Under these conditions the balance of payments deficit grows steadily, reaching 2,543 million of 1957 dollars by 1976. These deficits help to finance the high levels of investment in this projection. But in a direct and partial sense, they also contribute to the unemployment.

The final outcome of an economic system, from the point of view of its people, may perhaps be summed up in its level of employment, the hours of work and the material standard of living. The latter in the free projection grows at only 0.7 per cent. Private consumption grows at three per cent, public consumption grows at only two and one-half per cent, and population grows at two and one-quarter per cent. The standard of living for the employed population and those who receive the income of property and enterprise presumably would fare much better than this however. It is the large numbers of unemployed who drag the average standard of living down. Thus in summing up the outcome of this projection, we observe that it is prosperous for the owners of property and enterprise, and for the employed. But in terms of employment and average standard of living it produces unsatisfactory results.

Finally let us look at how this growing economy chooses to allocate its resources of production and trade to final uses. The percentage pattern of this allocation is set up in Table 2F.

From Table 2F we get the broad picture of a decline in allocation to both private and public consumption, partly related to the high level of unemployment. The proportion consumed for defence rises because in the projections with the econometric model we used the same series for defence expenditure as for PR–2, in which the level of GNE was much higher. This projection also produces a decline in the allocation to total government, and to exports.

Offsetting these declines we have a strong advance in the share allocated to investment, partly because of the steady growth, and partly because the investment equation seemed to generate too much demand. There was also a small increase in the share of imports, because of the strength of the demand forces built into the import equation from the heavy imports of recent years. This eventually produced rather serious balance of payments deficits.

To sum up, our free projection with the econometric model fitted to the Canadian data of 1926 to 1961 presents a picture of seemingly profitable and prosperous steady growth, but with growing unemployment. The unemployment would have been worse, but for the rapid decline in hours of work. What we have here seems remarkably like what we have discussed in Chapters 4 and 5 as technological unemployment – a structural problem. Intermixed with this structural problem is a weakness in aggregate demand. The standard of living for the country as a whole advances rather slowly under this situation.

In fact the model has presented a stylized version of something like the economic picture we have seen in North America in the 1957 to 1961 period indicating how it might look when projected into the future.

TABLE 2F

RESOURCE ALLOCATION TO FINAL USES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Consumption				Investment									
Year	Private C_o^c	Public C_g^{o}	Defence G_M^o	Total $C^{n,o}$ 1+2+3	Public GI_g^o	Inventories ΔH^o	Fixed Capital GI_{dPCM}^o	Total GI^{no} 5+6+7	Total Government G^o 2+3+5	Exports of Goods and Services $F_2'^o$	Imports of Goods and Services $F_1'^o$	Balance of Payments Surplus S_F^o 10–11	Residual Error $-\frac{1}{2}R_2^o$	GNE
1961	66.2	10.1	4.2	80.5	4.8	–.8	17.3	21.3	19.1	21.3	23.4	–2.1	0.2	100.0
1966	63.6	9.0	4.4	77.0	4.4	1.7	19.6	25.7	17.8	21.3	24.1	–2.8	–	100.0
1971	62.7	8.8	4.6	76.1	4.5	1.7	21.3	27.5	17.9	20.8	24.4	–3.6	–	100.0
1976	61.7	8.7	4.9	75.3	4.5	1.7	22.9	29.1	18.1	20.4	24.8	–4.4	–	100.0

Note: Allocation pattern as percentages of GNE adding to 100.0 except for rounding error.

B. Controlled Projection – PR–3C

Structural Defects in the Model

Now that we have seen the nature of the econometric growth model of Chapter 9, the way this model behaves in action, and some of its more obvious defects, we can set out to see how the model would work under policy control by a central government. To do this we shall first have to correct some of the apparent structural defects in this model. For only then can the model hope to give an approximate simulation of the real economy.

By structural defects, in this sense, we mean that certain functional forms or parameters in the model seem to be giving extreme results which are not likely to be found in the real economy. With more research resources these defects would have been corrected before attempting the free projection. As is was, we had to use the free projection for two purposes, the second of which was to discover the major areas of the model where correction would be needed if a proper simulation was to be obtained.

These areas seemed to be as follows.*Firstly* the hours equation being linear instead of exponential let hours fall too fast. It was decided to correct this by feeding positive cumulative amounts back into the constant term of the hours equation, so that the time path of hours would conform in growth with the exponential decline of PR–1 and PR–2. *Secondly* the rate of technical progress used in the production function may have been more than the economy could absorb in conjunction with the economies of scale (see p. 180) revealed in the production function, and the rapid expansion of capital goods in the model. It was decided, therefore to slow this variable down as might appear necessary as the projection proceeded. *Thirdly* investment and the stock of capital grew faster in the free projection than almost anything else, admittedly under the influence of the continuing steady growth of output. It was felt however that the equation of demand for private investment was responding more vigorously than we could expect in the real world. Besides giving a possible distortion in this way, it would also act, along with the technical progress variable, to contribute significantly to technological unemployment. This is because in our model there is a high substitution effect of capital for labour, should it be profitable to expand capital rapidly. It was decided to compensate for this vigour, as might appear necessary, by adding cumulative negative amounts to the constant term of the equation of demand for private gross investment in fixed capital.

These adjustments were made as deemed appropriate during the solutions for the controlled projection PR–3C. They are recorded in their cumulative amounts in Table 4, found in the Appendix of this chapter.

Policy Areas

The remaining alterations in PR–3C were performed as simulations of government policy, aimed at maximizing the general economic welfare in the hypothetical economy being projected by the econometric growth model. The areas

where government policy could be assumed to operate in this model can be classed as fiscal, foreign trade and consumption. Fiscal policy was carried out firstly by shifting the government disposable income function up or down, that is by making cumulative changes Δm_o on the constant term of that equation. Behind these broad changes there would be of course a complex of alterations in tax rates and transfer payments, all based on expert knowledge in public finance and its objectives. A second area for fiscal policy operations is of course the public spending of government. For this the government consumption equation was shifted up or down as the situation warranted, with cumulative changes Δb_o on the constant term of that equation. Behind these shifts of course would be all of the detail on the government shelf of potential consumption projects and their variations, accelerations and decelerations. A corresponding shelf of potential and socially desirable investment projects is an even more powerful tool of fiscal policy. The application of this tool would be represented by shifts in the GI_g equation. Such investment policy was not carried out in this projection, however, because the investment equation of the private sector was already too strong, and required structural adjustment to restrain it. It was consequently simpler to leave public investment alone, for it appeared to be operating satisfactorily, although it could have been the subject of policy if necessary.

Foreign trade policy was firstly to encourage the expansion of exports in step with the expansion of output, but without expecting exports to grow at quite as fast a rate as output. The other side of foreign trade policy is of course in the field of imports. The import equation in the model displayed embarrassing strength like the private investment equation. Hence there was a constant tendency toward a large and growing balance of payments deficit. This strength was probably built into the import demand equation by the high level of imports related to the capital inflow of the past decade. It was consequently necessary to apply almost continuous brakes to the import flow.

Again in the real world a whole complex of tools would be used to apply these brakes – exchange rate adjustment, exchange control, monetary policy, the tariff, import quotas, import controls. Some combination of these tools would be selected by the government of the day as most appropriate to each particular situation. In the model the net effect of these changes was taken care of by merely shifting the level of the equation (Δf_o). In a more detailed model the price of imports, reflecting the price of foreign exchange, would account for some of these shifts. In pursuing this policy the structural problems of Chapters 4 and 5 are in mind. Also it is assumed that in the course of the projection Canada will mature to a sufficient extent industrially, that capital inflows and balance of payments deficits will no longer be as desirable or as likely as for a developing economy.

With regard to policy on private consumption it was assumed that government could shift this demand as the occasion warranted, by the use of credit controls, as well as through its fiscal policy. The latter would affect consumer demand directly by alterations in tax and transfer payment rates. These will tend to shift income into or out of Y_g, with corresponding opposite shifts out of or into private disposable income Y. Some influence on C can also be obtained by government

through keeping the public constantly informed on its policy and on the immediate needs of the economy.

The cumulative amounts of these various policy operations on the model in the course of the controlled projection PR–3C are shown in Table 4 in the Appendix to this chapter.

The Goals of Policy

In this projection there were two major goals toward which policy was directed. First and foremost was high level employment. The second was a high growth path of standard of living, approaching an optimal level and slope or growth rate. This is in contrast to the rather inadequate result obtained on these counts in the free projection. There were also two secondary policy goals already implied above, and which could be interpreted as necessary to keep the economy on an even keel, or from experiencing serious disorders or further structural problems. One of these was to gradually eliminate the balance of payments deficits on current account, as the economy continued to mature. The other was to reduce the goverment deficit, to a level compatible with the needs of the economy for growth in the money supply, and such that the national debt would not in the long run get out of line with growth in GNP.

In Table 4 are set out the over-all net policy measures which attempted to steer the economy to the above goals and then keep it there.

The Development of Policy

The method of developing policy year by year was firstly to study the situation that had developed in the economy in the previous year. Attention was directed especially to the key points in the solution or outcome of the economic situation for that year. These were: the proportion unemployed N_u^o; the level and growth rate of the standard of living c^n and $\dot{c}^n$; the balance of payments surplus S_F; and the government surplus S_g. These may be called the *policy foci* of the model, when we take into account the specific goals above. They are also the equilibrating mechanisms of the model. But they are not automatic. They assume that government policy is deliberately applied to the policy variables to eliminate discrepancies between the observed policy foci and desired or aspirational values which the government has in mind.

The second step was to estimate which policy variables would need to be changed or would be the best ones to change to narrow or close the gap between the observed and the desired values of the foci of policy. This was followed by estimation of how much to change the policy variables selected. This estimation was done by a mental cut and try approach, along with the estimation of rough multipliers as the projection proceeded. A more scientific approach would have been to establish exact multipliers for each year, given the lagged and exogenous data appropriate to that year. But this would have involved several solutions to

the model for each year and was beyond the limited resources of this project. We had to try to eliminate the discrepancies around the policy foci using only one solution for each year, which was all that our computing time would permit.

Because of this limitation, we were unable to solve for an optimal policy combined with structural corrections for each year. Had we been able to do so we could have closed the discrepancies very early in the projection. As it turned it took many years and much experience before the policy and corrections began to converge the solutions to the desired goals.

One unfortunate lapse did occur however in the final solution in the projection for 1991. The balance of payments deficit had been eliminated by 1990 and converted into a slight surplus. But unemployment had become a problem again and it was wanted to bring this down to a proper level for the closing year. It became necessary to use strong expansionary policy in 1991 itself. It had not seemed necessary to do too much about imports because of the favourable surplus. Consequently, only mild policy was applied to imports, and with the strong expansion in the economy they surged up enough to cause a larger balance of payments deficit than would have been preferred.

The Results of the Controlled Projection – PR–3C

We begin with a tabulation of these results in Table 1C below.

From Table 1C we can draw a picture of the policy controlled projection. Output available to residents (GNP) had an over-all growth rate of 4.7 per cent. Looking at the five-year intervals this rate was highest (5.9 per cent) in 1971–1976 at which period, roughly, the crest of the postwar baby boom was reaching family formation ages. A strong policy to encourage and facilitate consumption was put in at this time, both as a recognition of population needs, and as a means of eliminating severe technological unemployment.

This over-all growth rate of output could have been exceeded as far as the supply side of the economy was concerned. Demand proved to be the limiting factor. Early attempts in the policy measures to stimulate demand proved to be too timid, and hence to preserve employment a temporary slowdown in technical progress was made. At the same time an almost continuous structural correction was applied to the private investment equation, which seemed to respond too vigorously to the high and steady growth rates.

We next look at employment and unemployment. In the early phases of our projection we were struggling with technological unemployment, just as in the free projection. This proved to be a most difficult problem to deal with, and it was only by 1973 that the proportion unemployed could be brought down as low as 4.5 per cent. It required structural adjustment of technical progress and investment, along with considerable encouragement to consumption. Actually the problem could have solved much earlier, and without holding back technical progress, if there had been time and resources to do more testing of alternative policies with the model. Of course, if technical progress had not been retarded somewhat growth rates obtained from this projection would have been higher than those shown in Table 1C.

TABLE 1C

THE CONTROLLED PROJECTION – PR–3C

MAIN ENDOGENOUS VARIABLES FROM ECONOMETRIC MODEL SOLUTIONS

	1	2	3	4	5	6	7	8	9	10	11
									Government Expenditures		
Year	Wages and Salaries-Civilian	Income of Property and Enterprise	Indirect Taxes Less Subsidies	Capital Consumption Allowances	Private Sector Disposable Income	Government Disposable Income	Gross National Product	Consumer Expenditure	Consumption	Investment	Total
Symbol	W_c	π	T_{i-s}	D	Y	Y_g	GNP	C	C_g	GI_g	G
Units	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$	m–57$
1961	17,742	8,034	4,362	4,012	24,745	5,910	34,529	22,859	3,486	1,670	6,608
1966	20,755	10,464	4,955	5,368	29,243	7,508	42,119	26,635	4,386	1,806	7,987
g	3.2	5.4	2.6	6.0	3.4	4.9	4.1	3.1	4.7	1.6	3.9
1971	26,297	13,136	6,098	6,667	36,445	9,733	52,845	34,179	5,843	2,170	10,270
g	4.8	4.7	4.2	4.4	4.5	5.3	4.6	5.1	5.9	3.7	5.2
1976	34,793	18,475	7,913	8,550	48,035	13,864	70,449	47,089	7,755	2,590	13,157
g	5.8	7.1	5.3	5.1	5.7	7.3	5.9	6.6	5.8	3.6	5.1
1981	43,925	23,729	9,806	10,597	61,273	16,977	88,847	60,353	9,719	3,068	16,259
g	4.8	5.1	4.4	4.4	5.0	4.1	4.7	5.1	4.6	3.4	4.3
1986	52,830	29,642	11,772	12,875	75,332	19,775	107,982	71,286	12,044	3,592	19,911
g	3.8	4.5	3.7	4.0	4.2	3.1	4.0	3.4	4.4	3.2	4.1
1991	69,189	37,642	14,904	16,383	96,643	26,030	139,056	93,537	15,612	4,157	25,053
g	5.5	4.9	4.8	4.9	5.1	5.7	5.2	5.6	5.3	3.0	4.7
tg	4.6	5.3	4.2	4.8	4.6	5.1	4.7	4.8	5.1	3.1	4.5

TABLE 1C (Cont'd.)

Year	12	13	14	15	16	17	18	19	20	21
	Business Gross Fixed Capital Formation	Exports of Goods and Services	Imports of Goods and Services	Employment	Unemployment	Unemployment as Percentage of Civilian Labour Force	Hours of Work	Labour Input-Man-hours	Average Real Output Per Man-Hour	Real Wage Rate
Symbol	GI_{dPCM}	F_2'	F_1'	N_e(ann. aver.)	N_u(ann. aver.)	N_u^o(ann. aver.)	h per yr.	$N_e h = L$	p_L	w_{hr}
Units	m–57$	m–57$	m–57$	t	t	%	1hr	m of m.–h's	1–57$/man-hour	1 –57$
1961	5,990	7,343	8,067	6,060	469	7.2	2,164	13,114	2.640	1.667
1966	7,389	8,873	9,474	6,496	857	11.7	2,072	13,458	3.143	1.887
g	4.3	3.9	3.3	1.4			–.9	.5	3.5	2.5
1971	8,379	10,554	11,365	7,349	949	11.4	2,008	14,753	3.599	2.144
g	2.5	3.5	3.7	2.5			–.6	1.9	2.7	2.6
1976	9,972	12,849	13,582	8,912	388	4.2	1,944	17,324	4.085	2.343
g	3.5	4.0	3.6	3.9			–.6	3.3	2.6	1.8
1981	11,720	15,493	16,114	10,256	97	0.9	1,885	19,328	4.618	2.600
g	3.3	3.8	3.5	2.8			–.6	2.2	2.3	2.2
1986	15,484	18,420	18,498	11,032	488	4.2	1,813	20,003	5.424	2.992
g	5.7	3.5	2.8	1.5			–.8	.7	5.3	2.8
1991	19,988	21,903	22,947	12,503	396	3.1	1,778	22,230	6.284	3.471
g	5.2	3.5	4.4	2.5			–.4	2.1	3.0	3.0
tg	4.1	3.7	3.9	2.4			–.6	1.8	2.9	2.5

TABLE 1C (Concl.)

	22	23	24	25	26	27	28	29
Year	National Stock of Repro-ducible Real Capital	Capital/ Labour Ratio	Capital/ Output Ratio	Saving-Investment Ratio (Re Production and Growth)	National Saving Ratio	Govern-ment Surplus, on National Accounts Definition	Balance of Payments Surplus on Current Account	Standard of Living or Nation-al Con-sumption Per Capita
Symbol	K	$\frac{K}{L}$	$K/GDP_{c=k}$	s X 100	s^{no}	S_g	S_F	c^n
Units	m—57$	57$/man-hour	r	%	%	m—57$	m—57$	1—57$
1961	102,050	7.782	2.948	21.1	19.5	—698	— 724	1,444.5
1966	122,554	9.106	2.897	23.1	22.1	—479	— 601	1,528.4
g	3.7							1.1
1971	144,915	9.823	2.729	21.2	20.0	—537	— 811	1,771.7
g	3.4							3.0
1976	171,774	9.915	2.427	18.9	18.2	707	— 733	2,173.3
g	3.5							4.2
1981	203,050	10.506	2.275	17.7	17.2	718	— 621	2,480.7
g	3.4							2.7
1986	243,123	12.155	2.241	18.7	18.9	—136	— 78	2,641.5
g	3.7							1.3
1991	297,425	13.379	2.129	18.3	17.7	977	—1,044	3,109.0
g	4.1							3.3
tg	3.6							2.6

Note: Notes to Table 1F apply equally to this Table 1C.

Employment grew at an overall rate of 2.4 per cent, slightly faster than the labour force, as was necessary to reduce the high unemployment rate of 1961.

Hours of work, given structural correction throughout the complete projection, declined at a negative growth rate of –0.6 per cent. This gave man-hours of labour input an overall growth rate of 1.8 per cent.

Turning now to the capital contribution to growth, we find public investment growing at over-all rate 3.1 per cent,[1] and private investment growing at 4.1 per cent. This results in the total stock of national reproducible capital, K, including inventories, growing at an over-all rate of 3.6 per cent. As we would expect from these rates, the capital/labour ratio is found to increase, while the capital/output ratio falls.

From Tables 3 and 4, shown in the Appendix at the end of this chapter, we discover the over-all growth rate of technical progress, after structural correction or adjustment, to be 1.4 per cent.

The last group of growth rates give us the general ingredients of our early theoretical growth rate formulas – in particular (15) of Chapter 3 and (9) of Chapter 8. When they are inserted into the formulas, along with a share of labour of .55 (roughly appropriate over the projection), we get a growth rate of 4.0 per cent. The fact that the rate obtained from the model is higher than this may be due to the negative constant term in the specific production function in the model. This results in an elasticity of production relative to factor inputs that is greater than one, which means increasing returns to labour and capital as the scale of output increases. (Canada has of course great natural resources relative to labour and capital.)

Let us now look at the benefits obtained from this high output growth path. First, private consumption grew at 4.8 per cent, and public consumption advanced at 5.1 per cent. This resulted in an overall standard of living expansion of 2.6 per cent per year. We find that the growth profile of the standard of living in the policy controlled model has a much higher level and growth rate or slope than was the case with the free projection. This difference confirms our theory of the importance of high level employment in optimizing this growth path, and is indeed of striking impressiveness.

The same kind of difference does not occur however in the case of real average hourly earnings. Hours fell faster in the free projection, and productivity increased faster. Consequently the real wage rate was higher in the free projection. But this was spread among fewer hours and fewer people, so that the standard of living was much lower. In the controlled projection productivity (relative to labour) grew at an overall rate of 2.9 per cent, and the real wage rate grew at 2.5 per cent.

Our earlier theory (Chapters 3 to 5) had led us to believe that as the capital/output ratio declines, the saving ratio would also decline. We find this confirmed in

[1] Note that GI_g can grow faster than N on which it depends because of the negative constant term in the equation for GI_g.

Table 1C. Note that differences between s×100 and S^{no} are mainly due to capital inflows, which contribute to s but not to S^{no}.

Turning to the public sector, we observe that government deficits cease to become a problem once we reach high employment rates. Government disposable income is quite responsive to high growth in output and low unemployment. Its overall growth rate is 5.1 per cent, but in the surge to high employment by 1976 it grew at rate 7.3 per cent. Total government spending on the other hand had an overall growth rate of 4.5 per cent.

Finally we note that the income of property and enterprise grows faster in both projections than labour income, and indeed in the policy controlled projection grows at an overall rate of 5.3 per cent. Business has its greatest prosperity in the buoyant economy, and the average rate of profit to reproducible capital (π/K) grows from 7.9 per cent in 1961 to 12.7 per cent in 1991.

As a consequence of these results we expect the share of labour to fall, as it does, from .585 in 1961 to .554 in 1991. This result can possibly be explained by the fact that capital grows faster than labour, output grows faster than either, and the real wage of labour has been tied in with the previous year's productivity.

Let us next look at how the economy of the controlled projection allocated its resources to final products. This allocation is set out in Table 2C, which follows.

From Table 2C we obtain the following picture of ultimate resource allocation. Consumption in the private sector declines at first, but gradually recovers and then exceeds its initial share. The share of public consumption increases slowly. The share of consumption in defence declines, because of the more rapid growth of output in this projection, in comparison to PR–1 and PR–2. The share of total national consumption, including defence, increases after an initial set back caused by high unemployment. All other components of final output had their share decreased, including the total government share, which decreased slightly. Imports were kept more in line with exports, and the balance of payments deficit became almost negligible in percentage terms.

The overall trend in allocation was a shift out of investment, partly as the balance of payments deficit vanished and with the remainder of the shift going into consumption. It is now evident that in our search for structural adjustments and policies which would take the economy along a high employment growth path, we have inadvertently reduced the saving ratio slightly. Other policies and adjustments could have been found which would have maintained or increased the saving ratio. As far as the model was concerned there was no dearth of investment opportunities. A high saving ratio would have produced a higher growth path with even larger growth rates.

Conclusion

Although our model has a number of imperfections, and is based on preliminary investigations, it was fitted to the actual Canadian historical data.

TABLE 2C

RESOURCE ALLOCATION TO FINAL USES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Year	Consumption				Investment				Total Government	Exports of Goods and Services	Imports of Goods and Services	Balance of Payments Surplus	Residual Error	GNE
	Private	Public	Defence	Total	Private									
					Public	Inventories	Fixed Capital	Total						
	C^o	C^o_g	G^o_M	$C^{n.o}$ 1+2+3	GI^o_g	ΔH^o	$GI^o_{dP\,CM}$	GI^{no} 5+6+7	G^o 2+3+5	$F_2^{\prime o}$	$F_1^{\prime o}$	S^o_F 10–11	$-\frac{1}{2}R^o_2$	
1961	66.2	10.1	4.2	80.5	4.8	–.8	17.3	21.3	19.1	21.3	23.4	–2.1	0.2	100.0
1966	63.2	10.4	4.3	77.9	4.3	+1.7	17.5	23.5	19.0	21.1	22.5	–1.4	–	100.0
1971	64.7	11.1	4.3	80.1	4.1	1.6	15.9	21.6	19.5	20.0	21.5	–1.5	–	100.0
1976	66.8	11.0	4.0	81.8	3.7	1.4	14.2	19.3	18.7	18.2	19.3	–1.1	–	100.0
1981	67.9	10.9	3.9	82.7	3.5	1.3	13.2	18.0	18.3	17.4	18.1	–0.7	–	100.0
1986	66.0	11.2	4.0	81.2	3.3	1.3	14.3	18.9	18.5	17.1	17.1	0.0	–	100.0
1991	67.3	11.2	3.8	82.3	3.0	1.1	14.4	18.5	18.0	15.8	16.5	–0.7	–	100.0

Note: Allocation pattern as percentages of GNE adding to 100.0 except for rounding error.

For the latter reason the trends it projects offer us some tentative conclusions. Perhaps the strongest point the model makes is that we may already be in, or are heading into, a period of technological unemployment. In our model technical progress and capital investment tend to grow rather vigorously, and while they stimulate demand initially, their ultimate and net effect is to displace labour.

A second point that the model makes is that it is possible in the modern economy to have relatively stable growth with a high and increasing rate of unemployment. It seems to be the downward rigidity of wage rates, combined with the automatic fiscal stabilizers of the modern economy that permit this kind of situation to exist. Were it not for these stabilizing factors, we could expect cycles of large amplitude, as in the 1930's and earlier. As it is we can keep unemployment relatively insulated from an otherwise prosperous economy.

A third main conclusion which the model suggests to us is that there are pronounced gains to be had from high employment policies. The greatest gain, of course, is in the social and economic welfare of those who otherwise would have suffered from unemployment. But there are quite remarkable supplementary benefits. The growth rate in the standard of living is tripled. The growth rate of total real output is increased by more than one percentage point. Business profits grow at an even more remarkable pace, and the rate of profit to reproducible capital is higher. Government deficits are reduced and then converted into surpluses.

High level employment is not only good for workers, it is even better for business and government. At least this is what our model says.

APPENDIX TO CHAPTER 10

TABLE 3
EXOGENOUS DATA

	1	2	3	4	5	6	7
Year	Total Canadian Population	Time from 1926 Origin	Civilian Labour Force incl. YNT	Technical Progress	Defence or Military Expense	Exports of Goods and Services GDP Basis	Employers Own Accts., and Unpaid Family Workers
Symbol	N (June 1)	t	N_{1-M} (ann. av.)	A	G_M	F_2	N_{enp} (ann. av.)
Units	m	1 yr.	m	r	b—57$	b—57$	m
1961	18.238	35	6.529	1.80367	1.452	7.156	1.142
1962	18.570	36	6.619	1.83433	1.515	7.534	1.134
1963	19.035	37	6.8468	1.86551	1.581	7.760	1.156
1964	19.447	38	7.0115	1.89722	1.649	7.993	1.167
1965	19.867	39	7.1801	1.92947	1.720	8.233	1.177
1966	20.296	40	7.3529	1.96227	1.795	8.480	1.187
1967	20.735	41	7.5330	1.99563	1.879	8.734	1.198
1968	21.184	42	7.7175	2.02956	1.967	8.996	1.208
1969	21.643	43	7.9065	2.06406	2.059	9.266	1.218
1970	22.112	44	8.1001	2.09915	2.156	9.544	1.228
1971	22.590	45	8.2984	2.13484	2.257	9.830	1.238
1972	23.096	46	8.4898	2.17113	2.358	10.125	1.245
1973	23.612	47	8.6857	2.20804	2.465	10.429	1.252
1974	24.141	48	8.8861	2.24558	2.575	10.742	1.260
1975	24.681	49	9.0911	2.28375	2.691	11.064	1.266
1976	25.234	50	9.3007	2.32257	2.812	11.396	1.273
1977	25.810	51	9.5022	2.36205	2.933	11.738	1.277
1978	26.398	52	9.7080	2.40220	3.059	12.090	1.280
1979	27.000	53	9.9182	2.44304	3.191	12.453	1.284
1980	27.616	54	10.1331	2.48457	3.328	12.827	1.287
1981	28.247	55	10.3526	2.52681	3.471	13.212	1.290
1982	28.878	56	10.5763	2.56977	3.619	13.608	1.291
1983	29.523	57	10.8049	2.61346	3.773	14.016	1.292
1984	30.183	58	11.0384	2.65789	3.933	14.436	1.294
1985	30.857	59	11.2769	2.70307	4.101	14.869	1.293
1986	31.546	60	11.5204	2.74902	4.275	15.315	1.294
1987	32.228	61	11.7836	2.79575	4.460	15.774	1.294
1988	32.925	62	12.0529	2.84328	4.653	16.247	1.293
1989	33.637	63	12.3283	2.89162	4.854	16.734	1.293
1990	34.364	64	12.6100	2.94078	5.064	17.236	1.291
1991	35.107	65	12.8981	2.99077	5.284	17.753	1.290

TABLE 3 (Concl.)
EXOGENOUS DATA

	8	9	10	11	12	13	14	15
Year	Defence Value added to GDP	Military Pay and Allowances (Purchasing Power)	Interest and Dividends Received from Abroad	Interest and Dividends Paid Abroad	Change in Inventories	Stock of Inventories	Altered Series for Controlled Projection PR–3C	
Symbol	G_{M1}	W_M	π_{id}	π_{di}	ΔH	H_j	A	F_2
Units	b–57$	b–57$	b–57$	b–57$	b–57$ Jan. 1–Dec. 31	b–57$ June 30	r	b–57$
1961	.479	.517	.187	.753	–.262	12.897	1.80367	7.156
1962	.48975	.528602	.1946	.7902	.549	13.041	1.83433	7.534
1963	.50074	.540464	.2022	.8274	.589	13.610	1.86551	7.760
1964	.51198	.552595	.2098	.8646	.629	14.219	1.89722	8.073
1965	.52347	.564997	.2174	.9018	.669	14.868	1.92947	8.356
1966	.53523	.577690	.225	.939	.709	15.557	1.96227	8.648
1967	.54754	.590976	.2366	.9774	.7326	16.2778	1.99563	8.951
1968	.56013	.604565	.2482	1.0158	.7562	17.0222	2.02956	9.264
1969	.57302	.618478	.2598	1.0542	.7798	17.7902	2.06406	9.588
1970	.58620	.632703	.2714	1.0926	.8034	18.5818	2.09915	9.924
1971	.59967	.647242	.283	1.131	.827	19.3970	2.09915	10.271
1972	.61226	.660831	.2970	1.1738	.8544	20.2377	2.09915	10.682
1973	.62512	.674711	.3110	1.2166	.8818	21.1058	2.09915	11.109
1974	.63825	.688882	.3250	1.2594	.9092	22.0013	2.13484	11.553
1975	.65165	.703345	.3390	1.3022	.9366	22.9242	2.17113	12.015
1976	.66533	.718111	.353	1.345	.964	23.8745	2.20804	12.496
1977	.67820	.732002	.3696	1.3924	.9984	24.8557	2.21908	12.933
1978	.69131	.746152	.3862	1.4398	1.0328	25.8713	2.23572	13.386
1979	.70468	.760582	.4028	1.4872	1.0672	26.9213	2.25808	13.921
1980	.71831	.775294	.4194	1.5346	1.1016	28.0057	2.29195	14.478
1981	.73220	.790285	.436	1.582	1.136	29.1245	2.33091	15.057
1982	.74534	.804468	.4562	1.6358	1.1846	30.2848	2.37054	15.584
1983	.75871	.818898	.4764	1.6896	1.2332	31.4937	2.41084	16.129
1984	.77232	.833588	.4966	1.7434	1.2818	32.7512	2.45182	16.694
1985	.78617	.848537	.5168	1.7972	1.3304	34.0573	2.49350	17.278
1986	.80029	.863777	.537	1.851	1.379	35.4120	2.53589	17.883
1987	.81369	.878240	.5624	1.9146	1.4076	36.8053	2.57900	18.509
1988	.82732	.892951	.5878	1.9782	1.4362	38.2272	2.62284	19.157
1989	.84118	.907911	.6132	2.0418	1.4648	39.6777	2.66743	19.827
1990	.85527	.923119	.6386	2.1054	1.4934	41.1568	2.71278	20.422
1991	.86960	.938585	.664	2.169	1.522	42.6645	2.71278	21.239

TABLE 4

POLICY OPERATIONS, AND ADJUSTMENTS FOR APPARENT STRUCTURAL DEFECTS

PR – 3C

(Cumulative Adjustments)

	1	2	3	4	5	6	7	8
Year			Policy Operations			Structural Corrections		
Variable	Y_g	C_g	C	F_1	F_2	h	A	GI_{dpCM}
Parameter	Δm_o	Δb_o	Δa_o	Δf_o		Δk_o		Δd_o
Units	b57$	b57$	b57$	b57$	b57$	t hrs.	r	b57$
1962..........		+.420		–.170	7.534	+.060		
1963..........		.420		–.370	7.760 + .080	+.060		
1964..........		.420		–.370	8.073 +3.5 p.c.	+.120		–.300
1965..........		.520		–.370	8.356 +3.5 p.c.	.132		–.400
1966..........		.620		–.370	8.648 +3.5	+.145		–.500
1967..........		.720		–.370	8.951 +3.5	.160		–.600
1968..........		.920		–.400	9.264 +3.5	.168		–.800
1969..........		1.020	+.140	–.400	9.588 +3.5	.204		–.900
1970..........		1.120	.840	–.500	9.924 +3.5 p.c.	.224	2.09915	–1.000
1971..........		1.220	1.640	–.700	10.271 +4.0	+.250	2.09915	–1.200
1972..........		1.330	2.640	–1.100	10.682 +4.0	.270	2.09915	–1.440
1973..........		1.430	3.890	–1.300	11.109 +4.0	.270	2.09915	–1.728
1974..........		1.530	5.453	–1.800	11.553 +4.0	.270	2.13484 +1.7 p.c.	–2.074
1975..........		1.630	2.177	–2.200	12.015 +4.0 p.c.	.270	2.17113 +1.7 p.c.	–2.100
1976..........		1.730	2.500	–2.200	12.496 +3.5	+.280	2.20804 +0.5	–2.200
1977..........		1.830	3.900	–2.300	12.933 +3.5	.300	2.21908 +0.75	–2.400
1978..........		1.930	4.750	–2.500	13.386 +4.0	.330	2.23572 +1.0	–2.600
1979..........	–.750	2.030	4.750	–2.900	13.921 +4.0	.350	2.25808 +1.5	–2.900
1980..........	–.750	2.130	4.750	–3.400	14.478 +4.0 p.c.	.370	2.29195 +1.7 p.c.	–3.200
1981..........	–1.000	2.230	4.500	–3.500	15.057 +3.5	+.370	2.33091 +1.7	–3.200
1982..........	–1.250	2.330	4.500	–3.800	15.584 +3.5	.400	2.37054 +1.7	–3.500
1983..........	–1.500	2.430	4.500	–4.200	16.129 +3.5	.430	2.41084 +1.7	–3.500
1984..........	–1.800	2.630	4.500	–4.600	16.694 +3.5	.480	2.45182 +1.7	–3.500
1985..........	–2.000	2.830	4.500	–5.000	17.278 +3.5 p.c.	.530	2.49350 +1.7 p.c.	–3.500
1986..........	–2.000	3.030	4.500	–5.400	17.883 +3.5	.560	2.53589 +1.7	–3.500
1987..........	–2.000	3.230	4.500	–5.800	18.509 +3.5	.600	2.57900 +1.7	–3.500
1988..........	–2.100	3.230	4.600	–6.600	19.157 +3.5	.680	2.62284 +1.7	–4.000
1989..........	–2.200	3.330	4.900	–7.000	19.827 +3.0	.730	2.66743 +1.7	–4.500
1990..........	–2.200	3.730	6.900	–7.200	20.422 +4.0 p.c.	.780	2.71278 +0.0 p.c.	–4.700
1991..........	–2.400	4.130	10.900	–7.500	21.239	.800	2.71278	–5.000

CHAPTER 11

CONCLUSIONS

This has been a study of Canadian economic growth. It began with theoretical preparation, moved into a broad empirical survey of Canadian growth since 1926, and finally used this background as a basis for the projection ot trends into the future. The purpose in all this was to provide an economic background which others might use in their studies of the trends and future possibilities of expanding health services in Canada. What conclusions can we now draw from our journey, with regard both to the possibilities of future economic growth, and to the relationship between such growth and any future expansion of the health services?

To begin, we can expect with a sense of realism that Canada's rate of growth of real GNP over the life of the next generation may be of the order of from three and one-half to five per cent, compounded per annum. This spectrum of rates is suggested by the historical record, and by the various models of growth we have developed to project past trends into the future.

The past history and experience of the economy, as well as our theory and our empirical models, show that we can only expect sustained growth rates at the higher end of the spectrum, if government engages in policies designed to achieve high level employment. Our theory and empirical models suggest that such policy will in the long run be mainly concerned with stimulating demand – the right kinds of demand, (consumer demand, or investment demand) at the right times. Potential or latent growth simply does not occur if sufficient demand is not there to draw it out. Of course we also know from our studies that anything government does to stimulate supply through encouraging education, research, technical progress and economic efficiency will also tend to increase our rate of growth. These kinds of supply response are indeed a vital part of our growth theory, and to them we can add corresponding effects on growth of expanding health research and services. We saw that growth starts from these forces, and then feeds back to facilitate and to stimulate their further development. This made our theory partially closed and endogenous. But demand will still always be a vital catalyst in the growth process.

Accompanying this range of growth rates in total output, we can anticipate improvements in our standard of living of from one to two and three-quarters per cent per annum. At the upper ranges of these rates our standard of living will double every twenty-five or thirty years, while at the same time our hours of work can

continue to decline at a rate of two-thirds of one per cent per year, as they have in the recent past.

Accompanying the high growth path, and of course very much a part of the whole process, is a very prosperous business community. Profits, the aggregate return from production to property and enterprise, are higher relative to capital invested, and grow at a faster and more stable rate, on the high employment growth path. They in turn help to sustain the high path, through their influence on investment.

Government also finds its financing much easier on the high employment path, even though it may have to stimulate or nudge the economy on to this path. At least this is what our econometric growth model tells us. Government revenues become more buoyant, transfer payments are reduced, and deficits are gradually replaced by small surpluses.

The upper ranges of the growth rates in our projections correspond to the "free high employment growth path" of our theory. No time or resources were available to experiment with the possibly more optimal growth paths – "the generation optimized", and the "Golden Rule" paths. To attain these paths government policy would have to go beyond the maintenance of high employment and set out to raise the saving-investing ratio of the economy. However, it is quite likely that such policies would create even higher growth profiles of the standard of living.

What do these economic results mean from the point of view of social policy with respect to the health services? Firstly let us remind ourselves that the economist takes social wants and preference systems as given. These are formed by those cultural institutions and forces in a society which give it its sense of values. It is then the function of the economist to analyse the most efficient way of satisfying the material wants in the social preference system, given their priorities and interrelationships. If the economy is operating at top capacity then to have more of one want means giving up some of the other wants. The ultimate balancing of resources of production with the system of preferences weighs the strength of each want against costs in terms of the alternative wants given up. But as the standard of living grows, all wants can be more fully satisfied, and some wants which were formerly considered as luxuries may gradually be taken more and more as necessities. In our policy controlled projection where we tried to maintain the economy at high capacity operations, the standard of living grew at a rate of 2.6 per cent overall, and in the thirty years of projection it increased by a factor of 2.15. Under such prosperous conditions there is every likelihood that the society would want to convert some of this new wealth to increasing the health services per capita, up to a point.

But if we assume a less favourable picture, with higher ratios of unemployment and unused capacity, the standard of living will not improve as rapidly as before, and there will be less choice and less monetary demand directed toward the health industry. However, it is just in this kind of situation that government needs to exert policy to restore high employment, while at the same time all of the additional goods produced by this policy are in a sense costless. For when resources

are idle, any additional goods produced as a result of government policy do not displace any other goods. Their cost in terms of alternative goods foregone is zero. By the same line of reasoning, idle resources in an economy are free goods, and there is no real cost in using them, until high level employment (and the boundary or limit of production) is reached. It will be understood of course, that government must still arrange the finance and organization to get idle resources into action, and may at the same time incur some real cost to the society in the form of any induced imports not covered by an increase in exports.

When a policy to increase employment is needed, it has been reasoned that the government may encourage private consumption and investing, and may also engage in more public consumption and investment by drawing on its shelves of high priority projects. If it felt that public preferences were shifting more in the direction of health services, then encouragement of both private and public advances in this industry would simultaneously serve several social ends. In the first place it would stand in its own right, by satisfying directly a growing social want. Next it would exert a strong influence on aggregate demand and hence employment in the economy. For the programme would not only employ more people directly, but it would also (under North American conditions) require extensive investment in fixed capital. The latter would consist of hospitals, and the considerable amounts of technical equipment that nowadays go into these. In this way it would serve the government's need for socially valuable ways and means to implement its high employment policies. Through this many families would be saved the hardships entailed in prolonged unemployment. Finally an increased volume of health services would stimulate economic growth. It would do this primarily through its expansion of demand. But it would also increase growth, and hence the standard of living through its effect on supply. For through the improved health and human attitudes which the programme would generate, we could confidently expect more advance in socio-technical progress and total productivity. This is of course the *external* economy of an expanded health programme. There are also external social benefits to a society in which there is less physical disease and mental disorder.

There are accordingly many facets to the social gains from increasing the health services. Rarely indeed could one expect to get so many major and wide-spread benefits out of one single programme.

Because of the external economies of improved health, the individual and the private economy are not likely to invest in this area to the full extent of social benefits. Hence some government leadership and assistance on the programme will be necessary. This may initially cause a certain amount of government deficit. On this point, we argued in Chapter 5 that such deficits need not be feared: to the extent that they create necessary increases in the money supply; to the extent that the servicing of the public debt is not too large relative to the national income; and to the extent that the deficit is incurred to finance a sound social and economic investment. In any event such deficits will largely disappear if the economy continues on a high employment growth path.

In summary then, the economic picture suggests that Canada can readily afford (or choose to afford) a considerable expansion of its health services. Basically it depends on public or social wants with respect to high level employment, and with respect to the way the society wishes to allocate growing real income.

We have the economic potential and we have the growth potential for an expanded health programme. And such a programme, in turn, will help us to realize this potential. Meanwhile the public has given a clear indication that it wants much wider health services available to all. On economic grounds we have seen that the question is not whether we can afford this, but rather whether we can afford not to do it. For we Canadians can move forward to an expanded system, rationally organized and financed, firm in the knowledge that there are only gains to be had — great economic, social, political and moral gains.

APPENDIX A — BASIC HISTORICAL DATA

Sections A — F

SECTION A – POPULATION AND EMPLOYMENT

TABLE A–1

POPULATION AND LABOUR MARKET

	1	2	3	4	5	6	7	8	9	10	11	12
Year	Total Canadian Resident Population	Total Labour Force Incl. Military, Yukon and North-west	Civilian Labour Force	Civilian Employment	Unemployment	Unemployment as Per cent of Civilian Labour Force	Paid Workers or Employees Civilian	Employers Own Accts. Without Employees Unpaid Family Workers	Average Hours of Work per Year per Worker	Man-Hours of Labour Input Civilian	Dependent Population Per Head of Working Population	Average Hourly Earning-Civilian
Symbol	N	N_1	$N_1 - N_M$	$N_{peg} = N_e$	N_u	N_u^o	N_{pg}	N_{enp}	h	$N_{peg}h = N_e h = L$	$\frac{N - N_{pegM}}{N_{pegM}}$	w_h
Units	June 1 1,000 or t people	ann. av. t.	ann. av. t.	ann. av. t.	ann. av. t.	%	ann. av. t.	ann. av. t.	1 hr.	m. m-h.	1 person	1c$
1926	9,451	3,582	3,578	3,471	107	3.0	2,117	1,354	2,867	9,951	1.720	.3898
1927	9,637	3,689	3,684	3,578	106	2.9	2,183	1,395	2,846	10,183	1.690	.4033
1928	9,835	3,799	3,794	3,705	89	2.3	2,297	1,408	2,832	10,493	1.651	.4174
1929	10,029	3,914	3,909	3,816	93	2.4	2,366	1,450	2,810	10,723	1.625	.4422
1930	10,208	4,014	4,009	3,724	285	7.1	2,234	1,490	2,765	10,297	1.737	.4510
1931	10,376	4,115	4,110	3,578	532	12.9	2,129	1,449	2,653	9,492	1.896	.4263
1932	10,510	4,187	4,182	3,405	777	18.6	1,959	1,446	2,577	8,775	2.082	.3912
1933	10,633	4,251	4,246	3,395	851	20.0	1,826	1,569	2,539	8,620	2.127	.3857
1934	10,741	4,317	4,312	3,572	740	17.2	1,998	1,574	2,595	9,269	2.003	.3740
1935	10,845	4,377	4,372	3,636	736	16.8	2,011	1,625	2,620	9,526	1.979	.3946
1936	10,950	4,438	4,432	3,703	729	16.4	2,042	1,661	2,641	9,780	1.952	.4155
1937	11,045	4,496	4,490	3,863	627	14.0	2,130	1,733	2,677	10,341	1.855	.4451
1938	11,152	4,556	4,549	3,853	696	15.3	2,121	1,732	2,674	10,303	1.889	.4434
1939	11,267	4,618	4,592	3,912	680	14.8	2,131	1,781	2,695	10,543	1.861	.4529
1940	11,381	4,671	4,537	3,998	539	11.9	2,247	1,751	2,734	10,931	1.754	.4817

TABLE A–1 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941	11,507	4,732	4,423	4,267	156	3.5	2,698	1,569	2,734	11,666	1.515	.4892
1942	11,654	–	–	4,432	–	–	2,914	1,518	2,723	12,068	1.356	.5396
1943	11,795	–	–	4,485	–	–	3,042	1,443	2,660	11,930	1.267	.5947
1944	11,946	–	–	4,473	–	–	3,082	1,391	2,616	11,701	1.274	.6199
1945	12,072	5,102	4,478	4,408	70	1.6	3,038	1,370	2,524	11,126	1.399	.6569
1946	12,292	4,962	4,837	4,671	166	3.4	3,140	1,531	2,447	11,430	1.563	.7141
1947	12,551	4,985	4,950	4,829	121	2.4	3,273	1,556	2,378	11,483	1.580	.8222
1948	12,823	5,032	4,996	4,871	125	2.5	3,364	1,507	2,390	11,642	1.613	.9221
1949	13,447	5,213	5,169	4,990	179	3.5	3,494	1,496	2,353	11,741	1.671	.9731
1950	13,712	5,222	5,170	4,973	197	3.8	3,520	1,453	2,346	11,667	1.729	1.0449
1951	14,009	5,310	5,232	5,089	143	2.7	3,716	1,373	2,289	11,649	1.711	1.1877
1952	14,459	5,431	5,333	5,178	155	2.9	3,867	1,311	2,281	11,811	1.741	1.2706
1953	14,845	5,511	5,406	5,244	162	3.0	3,962	1,282	2,281	11,962	1.775	1.3400
1954	15,287	5,617	5,503	5,253	250	4.5	3,969	1,284	2,263	11,888	1.848	1.3841
1955	15,698	5,737	5,620	5,374	246	4.4	4,141	1,233	2,249	12,086	1.859	1.4198
1956	16,081	5,910	5,793	5,596	197	3.4	4,397	1,199	2,249	12,585	1.815	1.5057
1957	16,589	6,131	6,014	5,736	278	4.6	4,544	1,192	2,216	12,711	1.834	1.5907
1958	17,048	6,258	6,138	5,706	432	7.0	4,560	1,146	2,197	12,536	1.926	1.6491
1959	17,442	6,359	6,239	5,866	373	6.0	4,732	1,134	2,192	12,858	1.914	1.6835
1960	17,814	6,533	6,414	5,966	448	7.0	4,846	1,120	2,177	12,988	1.928	1.7174
1961	18,238	6,650	6,529	6,060	469	7.2	4,918	1,142	2,164	13,114	1.971	1.7743

TABLE A–2

LABOUR MARKET PARTICIPATION RATES

	1	2	3	4	5	6	7	8	9	10	11
Year	General Participation Rate	Civilian Non-Institutional Population 14 Years of Age and Over — Labour Force Concepts									
		Total Participation Rate	Year	MEN — Participation Rates by Age Groups							
Symbol	100 pr_1 $=100N_1/N$	100 pr		All Ages	14 — 19	20 — 24	25 — 34	35 — 44	45 — 54	55 — 64	65+
Units	ann. av. %	ann. av. %		ann. av. %							
1926	37.9		1946	85.2	60.5	88.9	97.0		93.4		47.5
1927	38.3		1947	85.1	60.1	90.6	97.4		92.7		44.8
1928	38.6		1948	85.1	57.9	92.1	97.9		93.1		44.0
1929	39.0		1949	85.1	58.1	93.5	97.9		93.0		42.9
1930	39.3		1950	84.0	55.9	93.0	96.9	98.1	96.0	86.8	40.4
1931	39.7		1951	83.9	55.3	93.4	97.7	98.2	96.2	86.4	37.9
1932	39.8		1952	83.4	52.8	92.9	97.8	97.9	95.9	86.5	36.7
1933	40.0		1953	82.9	51.7	92.9	97.4	97.9	95.6	86.5	34.8
1934	40.2		1954	82.2	50.2	92.0	97.3	97.3	95.6	85.4	33.2
1935	40.4		1955	82.1	48.6	92.2	97.6	97.6	95.9	86.1	32.3
1936	40.5		1956	82.2	48.1	91.7	97.6	97.6	96.0	86.4	34.1
1937	40.7		1957	82.3	47.8	91.5	97.9	97.7	96.2	87.3	34.2
1938	40.8		1958	81.7	45.6	91.6	97.9	97.7	96.1	87.1	32.2
1939	41.0		1959	81.1	43.7	91.0	97.7	97.8	96.1	86.8	31.1
1940	41.0		1960	80.8	43.0	91.2	97.9	97.7	96.4	86.8	30.2
1941	41.1		1961	80.0	40.5	90.7	97.6	97.7	95.8	86.6	29.1

TABLE A–2 (Concl.)

	1	2	3	4	5	6	7	8	9	10	11
				WOMEN – Participation Rates by Age Groups							
Year			Year	All Ages	14 – 19	20 – 24	25 – 34	35 – 44	45 – 54	55 – 64	65+
1942	–	–	–								
1943	–	–	–								
1944	–	–	–								
1945	42.3	–	–								
1946	40.4	55.0	1946	24.7	37.8	48.1	23.2		15.3		5.0
1947	39.7	54.9	1947	24.1	36.6	45.3	22.9		15.5		5.7
1948	39.2	54.6	1948	23.5	33.4	45.4	22.8		16.2		5.0
1949	38.8	54.5	1949	23.5	35.1	46.0	22.9		15.4		4.7
1950	38.1	53.7	1950	23.2	33.0	46.4	24.0	20.5	18.9	13.2	4.2
1951	37.9	53.7	1951	23.5	34.2	46.9	24.0	21.3	20.3	12.7	4.1
1952	37.6	53.5	1952	23.7	33.1	47.1	24.1	22.5	20.6	13.4	3.9
1953	37.1	53.1	1953	23.4	33.2	47.2	23.9	22.1	20.5	12.9	3.6
1954	36.7	52.9	1954	23.7	33.6	46.6	24.4	22.1	21.1	14.0	3.7
1955	36.5	52.9	1955	23.9	32.9	46.3	24.2	23.2	22.2	14.7	3.9
1956	36.8	53.5	1956	24.9	33.9	47.1	25.1	23.8	24.4	15.9	4.5
1957	37.0	54.0	1957	25.8	33.1	46.5	26.2	25.3	26.2	18.1	5.0
1958	36.7	53.9	1958	26.3	32.1	47.4	26.2	26.2	27.5	19.0	5.2
1959	36.5	53.9	1959	26.7	32.0	46.5	26.5	27.5	28.7	20.0	5.1
1960	36.7	54.3	1960	28.0	32.6	48.1	27.3	29.4	30.4	21.2	5.5
1961	36.5	54.3	1961	28.8	32.4	48.8	28.1	30.1	32.2	23.2	5.8

SECTION B – REPRODUCIBLE WEALTH, AND MISCELLANEOUS

TABLE B–1

STOCKS OF PHYSICAL CAPITAL AND CERTAIN MISCELLANEOUS DATA

	1	2	3	4	5	6	7	8	9	10	11	12	13
	National Physical Capital Incl. Gov't., Excl. Military												
Year	Machinery and Equipment	Dwellings, Plant and Construction	Total Fixed Capital	Inventory Stocks Excl. Gov't.	Total National Physical Capital	Capital in Use, i.e., Adjusted for Unemployment	Exports, Excl. Interest and Dividends	Imports, Excl. Interest and Dividends	National Investment in Fixed Capital	Real Depreciation on National Fixed Capital	Indirect Taxes Less Subsidies	Gross Property-Enterprise Income	Implicit Price Index of NNP
Symbol	K^n_M	K^n_{dPC}	K^n_{dPCM}	H_j	K	K_p	F_2	F_1	GI^n_{dPCM}	D^n_r	T_{i-s}	$(\pi + D)$	P 1957 Value = 100.000
Units	June 30 m57$	June 30 m57$	June 30 m57$	June 30 m57$	June 30 m57$	June 30 m57$	m57$	m57$	m57$	m57$	m57$	m57$	
1926	4,935	38,344	43,279	4,708	47,987	47,554	2,766	2,268	1,720	n.a.	1,174	4,527	52.125
1927	5,099	38,235	43,334	5,092	48,426	48,036	2,755	2,500	2,082	2,027	1,230	4,887	51.544
1928	5,356	38,414	43,770	5,518	49,288	49,157	3,120	2,811	2,479	2,043	1,325	5,409	51.257
1929	5,716	38,763	44,479	5,760	50,239	50,061	2,900	3,012	2,790	2,081	1,319	4,955	51.628
1930	5,881	38,940	44,821	5,958	50,779	48,493	2,502	2,572	2,480	2,138	1,178	4,241	50.331
1931	5,687	38,796	44,483	5,929	50,412	45,563	2,250	1,824	1,826	2,164	1,177	3,144	47.332
1932	5,288	38,105	43,393	5,666	49,059	41,856	2,088	1,423	1,045	2,135	1,263	2,650	42.502
1933	4,874	37,234	42,108	5,440	47,548	39,969	2,108	1,410	777	2,062	1,286	2,709	41.741
1934	4,595	36,505	41,100	5,332	46,432	40,185	2,356	1,592	971	1,979	1,366	3,324	42.308
1935	4,425	35,920	40,345	5,416	45,761	39,790	2,585	1,752	1,162	1,917	1,376	3,688	42.522
1936	4,353	35,455	39,808	5,346	45,154	39,422	3,117	2,009	1,338	1,875	1,500	3,927	43.991
1937	4,490	35,228	39,718	5,253	44,971	40,205	3,194	2,382	1,759	1,849	1,573	4,460	44.808
1938	4,597	34,918	39,515	5,439	44,954	39,699	2,885	2,137	1,653	1,856	1,427	4,468	44.766
1939	4,648	34,631	39,279	5,972	45,251	40,223	3,210	2,297	1,622	1,858	1,650	5,118	44.474
1940	4,951	34,274	39,225	6,716	45,941	42,058	3,691	2,687	1,800	1,854	1,793	5,918	46.360

TABLE B–1 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
1941..........	5,406	34,056	39,462	7,113	46,575	45,983	4,860	3,262	2,115	1,878	2,108	6,617	50.042
1942..........	5,678	33,878	39,556	7,334	46,890	46,890	4,340	3,608	1,996	1,902	2,077	8,170	52.292
1943..........	5,617	33,787	39,404	7,348	46,752	46,752	6,081	4,453	1,764	1,916	2,068	7,591	54.057
1944..........	5,837	33,599	39,436	7,068	46,504	46,504	5,865	5,378	1,935	1,903	1,991	8,060	55.842
1945..........	6,153	33,517	39,670	6,702	46,372	46,372	5,726	4,221	2,128	1,894	1,751	7,820	57.325
1946..........	6,609	33,935	40,544	6,743	47,287	46,719	4,659	3,856	2,762	1,888	2,177	8,427	58.326
1947..........	7,602	34,874	42,476	7,332	49,808	49,638	5,381	5,015	3,852	1,920	2,488	8,846	64.626
1948..........	8,649	36,048	44,697	7,684	52,381	52,158	5,453	4,514	4,245	2,024	2,425	8,912	72.770
1949..........	9,642	37,508	47,150	7,774	54,924	54,217	5,211	4,583	4,614	2,161	2,392	8,701	75.573
1950..........	10,575	39,111	49,686	8,178	57,864	56,970	5,181	4,965	4,851	2,315	2,579	9,805	77.550
1951..........	11,614	40,657	52,271	9,111	61,382	61,016	5,455	5,490	5,055	2,470	2,884	10,479	85.613
1952..........	12,721	42,460	55,181	9,996	65,177	64,680	5,835	5,601	5,543	2,633	3,016	10,404	90.098
1953..........	13,854	44,479	58,333	10,710	69,043	68,460	5,763	6,110	5,961	2,809	3,229	10,366	90.150
1954..........	14,633	46,549	61,182	10,957	72,139	70,609	5,533	5,752	5,838	2,989	3,181	9,636	92.643
1955..........	15,447	49,029	64,476	11,091	75,567	74,020	5,825	6,513	6,453	3,159	3,474	11,237	93.178
1956..........	16,797	52,464	69,261	11,911	81,172	80,202	6,188	7,402	8,137	3,352	3,742	12,104	97.162
1957..........	18,070	56,170	74,240	12,570	86,810	84,880	6,238	7,224	8,585	3,606	3,861	11,604	100.000
1958..........	18,776	59,864	78,640	12,528	91,168	87,236	6,199	6,696	8,261	3,861	3,812	11,701	101.836
1959..........	19,502	63,091	82,593	12,533	95,126	91,822	6,427	7,391	8,050	4,097	4,071	12,177	104.422
1960..........	20,160	65,891	86,051	12,862	98,913	94,610	6,709	7,318	7,800	4,342	4,205	12,101	105.725
1961..........	20,411	68,742	89,153	12,897	102,050	97,414	7,156	7,314	7,660	4,558	4,362	12,046	106.437

SECTION C – ALLOCATION OF NATIONAL PRODUCT TO FINAL USES

TABLE C–1

GROSS NATIONAL EXPENDITURE IN CONSTANT DOLLARS AND MAJOR COMPONENTS OF FINAL DEMAND

	1	2	3	4	5	6	7	8	9	10	11	12
			Gross Fixed Investment									
Year	Consumer Expenditures	Government Expenditures	Dwellings	Plant and Construction	Machinery and Equipment	Total	Change in Inventories	Exports of Goods and Services	Imports of Goods and Services	Residual Error of Estimate	Gross National Expenditure	Government Investment (Non-Defence)
Symbol	C	G	GI_d	GI_{PC}	GI_M	$GI + GI_d$	ΔH	F_2^*	F_1^*	$-\frac{1}{2}R_2$	GNE	GI_g
Units	m57$	m57$	m57$	m57$	m57$	m57$	m57$	m57$	m57$	m57$	m57$	m57$
1926	6,772	1,034	421	516	556	1,493	277	2,822	−2,662	306	10,043	227
1927	7,534	1,133	428	642	721	1,791	491	2,829	−2,932	104	10,948	291
1928	8,277	1,185	450	867	829	2,146	363	3,203	−3,288	81	11,966	333
1929	8,768	1,340	450	998	957	2,405	119	3,013	−3,586	−52	12,009	385
1930	8,378	1,536	383	813	793	1,989	279	2,619	−3,259	−47	11,495	491
1931	7,935	1,513	340	606	466	1,412	−338	2,358	−2,606	−245	10,029	414
1932	7,311	1,358	212	288	252	752	−187	2,176	−2,232	−171	9,007	293
1933	7,126	1,099	178	191	200	570	−266	2,203	−2,115	−187	8,430	207
1934	7,482	1,196	218	221	277	716	50	2,489	−2,252	−241	9,439	255
1935	7,799	1,268	255	275	347	876	117	2,736	−2,403	−232	10,162	286
1936	8,155	1,254	304	345	421	1,070	−257	3,288	−2,725	−164	10,622	268
1937	8,669	1,378	356	405	613	1,374	72	3,358	−3,013	−155	11,682	385
1938	8,554	1,468	327	376	595	1,297	300	3,034	−2,822	−72	11,759	356
1939	8,788	1,507	381	365	556	1,302	766	3,338	−3,009	−63	12,628	320
1940	9,500	2,340	383	446	831	1,660	721	3,795	−3,347	−207	14,462	140

TABLE C–1 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941	10,099	3,302	450	583	1,045	2,079	74	4,975	−3,836	−149	16,545	36
1942	10,392	6,766	376	671	890	1,937	367	4,457	−4,110	−189	19,619	59
1943	10,669	7,455	363	655	507	1,525	−338	6,180	−4,917	−241	20,333	239
1944	11,414	8,475	423	455	646	1,525	−223	5,980	−5,815	−266	21,090	410
1945	12,527	5,923	498	450	806	1,754	−507	5,854	−4,622	−342	20,588	374
1946	13,946	2,991	541	727	1,014	2,282	588	4,763	−4,306	−52	20,212	480
1947	14,102	2,448	807	926	1,569	3,303	590	5,480	−5,526	42	20,439	549
1948	13,829	2,517	844	1,125	1,681	3,650	115	5,548	−4,961	123	20,821	595
1949	14,454	2,815	1,051	1,217	1,744	4,012	65	5,321	−5,098	58	21,626	602
1950	15,405	2,967	1,102	1,307	1,781	4,191	742	5,292	−5,566	87	23,118	660
1951	15,637	3,713	962	1,421	1,985	4,368	1,123	5,580	−5,983	105	24,542	687
1952	16,717	4,653	975	1,634	2,138	4,748	647	6,000	−6,042	−221	26,501	795
1953	17,650	4,654	1,198	1,728	2,269	5,195	781	5,950	−6,558	−155	27,516	766
1954	17,920	4,614	1,264	1,699	2,010	4,973	−286	5,700	−6,225	15	26,711	865
1955	18,770	5,136	1,431	1,878	2,143	5,453	554	6,000	−7,023	115	29,006	1,000
1956	19,478	5,664	1,567	2,666	2,781	7,014	1,086	6,333	−7,921	−146	31,508	1,123
1957	20,072	5,722	1,409	3,103	2,823	7,335	231	6,391	−7,813	−29	31,909	1,250
1958	20,707	6,113	1,722	2,767	2,336	6,825	−314	6,365	−7,313	−99	32,284	1,436
1959	21,630	6,171	1,633	2,473	2,456	6,562	324	6,610	−8,058	42	33,281	1,488
1960	22,212	6,257	1,323	2,404	2,504	6,231	333	6,884	−7,977	−33	33,907	1,569
1961	22,859	6,608	1,329	2,460	2,201	5,990	−262	7,343	−8,067	58	34,529	1,670

TABLE C–2

NATIONAL CONSUMPTION, INVESTMENT AND TRADE BALANCE

	1	2	3	4	5	6	7	8	9	10	11	12
							Percentage Allocation of Resources to Final Uses					
Year	National Consumption	National Investment	Trade Balance	Defence or Military Expense	Residual Error of Estimate	Gross National Expenditure	National Consumption	National Investment	Trade Balance	Residual Error	Total National Saving (Incl. Residual)	Defence
Symbol	$C^n = C + C_g$	$GI^n = GI_d + GI + GI_g + \Delta H$	$F'_2 - F'_1 = F' = S_F$	G_M	$-\frac{1}{2}R_2$	GNE	C^{no}	GI^{no}	$F'^o = S^o_F$	$-\frac{1}{2}R^o_2$	S^{no}	G^o_M
Units	m57$	m57$	m57$	m57$	m57$	m57$	%	%	%	%	%	%
1926	7,545	1,997	160	34	306	10,043	75.1	19.9	1.6	3.0	24.5	0.3
1927	8,334	2,573	−103	43	104	10,948	76.1	23.5	−0.9	0.9	23.5	0.4
1928	9,086	2,842	− 85	43	81	11,966	75.9	23.8	−0.7	0.7	23.7	0.4
1929	9,676	2,909	−573	47	− 52	12,009	80.6	24.2	−4.8	−0.4	19.0	0.4
1930	9,371	2,759	−640	52	− 47	11,495	81.5	24.0	−5.6	−0.4	18.0	0.5
1931	8,994	1,488	−248	41	−245	10,029	89.7	14.8	−2.5	−2.4	9.9	0.4
1932	8,345	858	− 56	32	−171	9,007	92.7	9.5	−0.6	−1.9	7.0	0.4
1933	7,971	511	88	47	−187	8,430	94.6	6.1	1.0	−2.2	4.9	0.6
1934	8,372	1,021	237	52	−241	9,439	88.7	10.8	2.5	−2.6	10.8	0.6
1935	8,720	1,279	333	61	−232	10,162	85.8	12.6	3.3	−2.3	13.6	0.6
1936	9,085	1,081	563	56	−164	10,622	85.5	10.2	5.3	−1.5	13.9	0.5
1937	9,588	1,831	345	74	−155	11,682	82.1	15.7	3.0	−1.3	17.3	0.6
1938	9,586	1,953	212	81	− 72	11,759	81.5	16.6	1.8	−0.6	17.8	0.7
1939	9,817	2,388	329	158	− 63	12,628	77.7	18.9	2.6	−0.5	21.0	1.3
1940	10,592	2,521	448	1,108	−207	14,462	73.2	17.4	3.1	−1.4	19.1	7.7

TABLE C–2 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941.......	11,275	2,189	1,139	2,090	-149	16,545	68.1	13.2	6.9	-0.9	19.2	12.6
1942.......	11,424	2,363	347	5,676	-189	19,619	58.2	12.0	1.8	-1.0	12.8	28.9
1943.......	11,505	1,426	1,263	6,381	-241	20,333	56.6	7.0	6.2	-1.2	12.0	31.4
1944.......	12,168	1,712	165	7,311	-266	21,090	57.7	8.1	0.8	-1.3	7.6	34.7
1945.......	13,489	1,621	1,232	4,588	-342	20,588	65.5	7.9	6.0	-1.7	12.2	22.3
1946.......	15,074	3,350	457	1,383	- 52	20,212	74.6	16.6	2.3	-0.3	18.6	6.8
1947.......	15,645	4,442	- 46	356	42	20,439	76.5	21.7	-0.2	0.2	21.7	1.7
1948.......	15,412	4,360	587	339	123	20,821	74.0	20.9	2.8	0.6	24.4	1.6
1949.......	16,191	4,679	223	475	58	21,626	74.9	21.6	1.0	0.3	22.9	2.2
1950.......	17,090	5,593	- 274	622	87	23,118	73.9	24.2	-1.2	0.4	23.4	2.7
1951.......	17,360	6,178	- 403	1,303	105	24,542	70.7	25.2	-1.6	0.4	24.0	5.3
1952.......	18,600	6,190	- 42	1,974	-221	26,501	70.2	23.4	-0.2	-0.8	22.4	7.4
1953.......	19,501	6,742	- 608	2,036	-155	27,516	70.9	24.5	-2.2	-0.6	21.7	7.4
1954.......	19,837	5,552	- 525	1,832	15	26,711	74.3	20.8	-2.0	0.1	18.9	6.9
1955.......	20,974	7,007	-1023	1,931	115	29,006	72.3	24.2	-3.5	0.4	21.0	6.7
1956.......	22,129	9,223	-1588	1,890	-146	31,508	70.2	29.3	-5.0	-0.5	23.8	6.0
1957.......	22,778	8,816	-1422	1,766	- 29	31,909	71.4	27.6	-4.5	-0.1	23.1	5.5
1958.......	23,769	7,947	- 948	1,615	- 99	32,284	73.6	24.6	-2.9	-0.3	21.4	5.0
1959.......	24,822	8,374	-1448	1,491	42	33,281	74.6	25.2	-4.4	0.1	20.9	4.5
1960.......	25,462	8,133	-1093	1,438	- 33	33,907	75.1	24.0	-3.2	-0.1	20.7	4.2
1961.......	26,345	7,398	- 724	1,452	58	34,529	76.3	21.4	-2.1	0.2	19.5	4.2

TABLE C-3

Per Capita National Spending

GROSS NATIONAL EXPENDITURE AND MAJOR COMPONENTS IN CONSTANT DOLLARS PER CAPITA

	1	2	3	4	5	6	7	8	9	10	11
			Gross Fixed Investment								
Year	Consumer Expenditure	Government Expenditures	Dwellings	Plant and Construction	Machinery and Equipment	Total	Change in Inventories	Exports of Goods and Services	Imports of Goods and Services	Residual Error of Estimate	Gross National Expenditure
Symbol	c	g	gi_d	gi_{PC}	gi_M	gi_d+gi	Δh	f''_2	f''_1	$-\frac{1}{2}r_2$	gne
Units	1957$										1957$
1926	716.5	109.4	44.5	54.6	58.8	157.9	29.3	298.6	-281.7	32.4	1,062.6
1927	781.8	117.6	44.4	66.6	74.8	185.8	50.9	293.6	-304.2	10.8	1,136.0
1928	841.6	120.5	45.8	88.2	84.3	218.3	36.9	325.7	-334.3	8.2	1,216.7
1929	874.3	133.6	44.9	99.5	95.4	239.8	11.9	300.4	-357.6	-5.2	1,197.4
1930	820.7	150.5	37.5	79.6	77.7	194.8	27.3	256.6	-319.3	-4.6	1,126.1
1931	764.7	145.8	32.8	58.4	44.9	136.1	-32.6	227.3	-251.2	-23.6	966.6
1932	695.6	129.2	20.2	27.4	24.0	71.6	-17.8	207.0	-212.4	-16.3	857.0
1933	670.2	103.4	16.7	18.0	18.8	53.5	-25.0	207.2	-198.9	-17.6	792.8
1934	696.6	111.3	20.3	20.6	25.8	66.7	4.7	231.7	-209.7	-22.4	878.8
1935	719.1	116.9	23.5	25.4	32.0	80.9	10.8	252.3	-221.6	-21.4	937.0
1936	744.7	114.5	27.8	31.5	38.4	97.7	-23.5	300.3	-248.9	-15.0	970.0
1937	784.9	124.8	32.2	36.7	55.5	124.4	6.5	304.0	-272.8	-14.0	1,057.7
1938	767.0	131.6	29.3	33.7	53.4	116.4	26.9	272.1	-253.0	-6.5	1,054.4
1939	780.0	133.8	33.8	32.4	49.3	115.5	68.0	296.3	-267.1	-5.6	1,120.8
1940	834.7	205.6	33.7	39.2	73.0	145.9	63.4	333.5	-294.1	-18.2	1,270.7

TABLE C–3 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11
1941	877.6	287.0	39.1	50.7	90.8	180.6	6.4	432.3	−333.4	−12.9	1,437.8
1942	891.7	580.6	32.3	57.6	76.4	166.3	31.5	382.4	−352.7	−16.2	1,683.5
1943	904.5	632.0	30.8	55.5	43.0	129.3	−28.7	524.0	−416.9	−20.4	1,723.9
1944	955.5	709.4	35.4	38.1	54.1	127.6	−18.7	500.6	−486.8	−22.3	1,765.4
1945	1,037.7	490.6	41.3	37.3	66.8	145.4	−42.0	484.9	−382.9	−28.3	1,705.4
1946	1,134.6	243.3	44.0	59.1	82.5	185.6	47.8	387.5	−350.3	−4.2	1,644.3
1947	1,123.6	195.0	64.3	73.8	125.0	263.1	47.0	436.6	−440.3	3.3	1,628.5
1948	1,078.5	196.3	65.8	87.7	131.1	284.6	9.0	432.7	−386.9	9.6	1,623.7
1949	1,074.9	209.3	78.2	90.5	129.7	298.4	4.8	395.7	−379.1	4.3	1,608.2
1950	1,123.5	216.4	80.4	95.3	129.9	305.6	54.1	385.9	−405.9	6.3	1,686.0
1951	1,116.2	265.0	68.7	101.4	141.7	311.8	80.2	398.3	−427.1	7.5	1,751.9
1952	1,156.2	321.8	67.4	113.0	147.9	328.3	44.7	415.0	−417.9	−15.3	1,832.8
1953	1,189.0	313.5	80.7	116.4	152.8	349.9	52.6	400.8	−441.8	−10.4	1,853.6
1954	1,172.2	301.8	82.7	111.1	131.5	325.3	−18.7	372.9	−407.2	1.0	1,747.3
1955	1,195.7	327.2	91.2	119.6	136.5	347.3	35.3	382.2	−447.4	7.3	1,847.8
1956	1,211.2	352.2	97.4	165.8	172.9	436.1	67.5	393.8	−492.6	−9.1	1,959.3
1957	1,210.0	344.9	84.9	187.1	170.2	442.2	13.9	385.3	−471.0	−1.7	1,923.5
1958	1,214.6	358.6	101.0	162.3	137.0	400.3	−18.4	373.4	−429.0	−5.8	1,893.7
1959	1,240.1	353.8	93.6	141.8	140.8	376.2	18.6	379.0	−462.0	2.4	1,908.1
1960	1,246.9	351.2	74.3	135.0	140.6	349.9	18.7	386.4	−447.8	−1.9	1,903.4
1961	1,253.4	362.3	72.9	134.9	120.7	328.5	−14.4	402.6	−442.3	3.2	1,893.2

TABLE C-4

Per Capita National Spending

NATIONAL CONSUMPTION, INVESTMENT AND TRADE BALANCE IN CONSTANT DOLLARS PER CAPITA

	1	2	3	4	5	6	7	8	9	10	11	12
Year	National Consumption	National Investment	Trade Balance	Defence or Military Expense	Residual Error of Estimate	Gross National Expenditure	Total National Saving, Including Residual	Net Interest and Dividends Paid Abroad	Total Domestic Saving Including Residual	Gross Domestic Expenditure	Public Consumption (Non-Defence)	Government Investment (Non-Defence)
Symbol	c^n	gi^n	f^*	g_M	$-\frac{1}{2}r_2$	gne	s^n	$\pi^n_{di} = \pi_{di} - \pi_{id}$	$s^n + \pi^n_{di}$	gde	c_g	gi_g
Units	1957 $						2+3+5					1957 $
1926	798.3	211.3	16.9	3.6	32.4	1,062.6	260.6	35.8	296.4	1,098.4	81.8	24.0
1927	864.8	267.0	-10.7	4.5	10.8	1,136.0	267.1	37.1	304.2	1,173.2	83.0	30.2
1928	923.8	289.0	- 8.6	4.4	8.2	1,216.7	288.6	40.1	328.7	1,256.7	82.2	33.9
1929	964.8	290.1	-57.1	4.7	- 5.2	1,197.4	227.7	46.0	273.7	1,243.5	90.5	38.4
1930	918.0	270.3	-62.7	5.1	- 4.6	1,126.1	203.0	55.8	258.8	1,181.9	97.3	48.1
1931	866.8	143.4	-23.9	4.0	-23.6	966.6	95.9	65.0	160.9	1,031.5	102.1	39.9
1932	794.0	81.6	- 5.3	3.0	-16.3	857.0	60.0	68.6	128.6	925.5	98.4	27.9
1933	749.6	48.1	8.3	4.4	-17.6	792.8	38.7	57.4	96.1	850.2	79.4	19.5
1934	779.4	95.1	22.1	4.8	-22.4	878.8	94.7	49.1	143.8	927.8	82.8	23.7
1935	804.1	117.9	30.7	5.6	-21.4	937.0	127.2	46.1	173.3	983.1	85.0	26.4
1936	829.7	98.7	51.4	5.1	-15.0	970.0	135.2	49.8	185.0	1,019.8	85.0	24.5
1937	868.1	165.8	31.2	6.7	-14.0	1,057.7	183.0	42.3	225.3	1,100.0	83.2	34.9
1938	859.6	175.1	19.0	7.3	- 6.5	1,054.4	187.7	48.1	235.8	1,102.5	92.6	31.9
1939	871.3	211.9	29.2	14.0	- 5.6	1,120.8	235.6	51.8	287.4	1,172.6	91.3	28.4
1940	930.7	221.5	39.4	97.4	-18.2	1,270.7	242.7	48.9	291.6	1,319.6	96.0	12.3

TABLE C–4 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941	979.8	190.2	99.0	181.6	−12.9	1,437.8	276.3	39.9	316.2	1,477.7	102.2	3.1
1942	980.3	202.8	29.8	487.0	−16.2	1,683.5	216.3	33.0	249.3	1,716.5	88.6	5.1
1943	975.4	120.9	107.1	541.0	−20.4	1,723.9	207.5	30.9	238.4	1,754.8	70.9	20.3
1944	1,018.6	143.3	13.8	612.0	−22.3	1,765.4	134.9	27.0	161.9	1,792.4	63.1	34.3
1945	1,117.4	134.3	102.1	380.1	−28.3	1,705.4	208.0	22.6	230.6	1,728.0	79.7	31.0
1946	1,226.3	272.5	37.2	112.5	4.2	1,644.3	305.5	28.1	333.6	1,672.5	91.7	39.0
1947	1,246.5	353.9	− 3.7	28.4	3.3	1,628.5	353.6	32.8	386.4	1,661.3	122.9	43.7
1948	1,201.9	340.0	45.8	26.4	9.6	1,623.7	395.4	27.5	422.9	1,651.2	123.4	46.4
1949	1,204.1	348.0	16.6	35.3	4.3	1,608.2	368.9	30.1	399.0	1,638.4	129.2	44.8
1950	1,246.4	407.9	−20.0	45.4	6.3	1,686.0	394.3	35.7	430.0	1,721.7	122.9	48.1
1951	1,239.2	441.0	−28.8	93.0	7.5	1,751.9	419.7	26.3	446.0	1,778.1	123.0	49.0
1952	1,286.4	428.1	− 2.9	136.5	−15.3	1,832.8	409.9	19.1	429.0	1,851.9	130.2	55.0
1953	1,313.6	454.2	−41.0	137.2	−10.4	1,853.6	402.8	17.6	420.4	1,871.1	124.6	51.6
1954	1,297.6	363.2	−34.3	119.8	1.0	1,747.3	329.8	20.0	349.8	1,767.3	125.4	56.6
1955	1,336.1	446.4	−65.2	123.0	7.3	1,847.8	388.5	21.3	409.8	1,869.1	140.4	63.7
1956	1,376.1	573.5	−98.8	117.5	− 9.1	1,959.3	465.7	23.3	489.0	1,982.6	164.9	69.8
1957	1,373.1	531.4	−85.7	106.5	− 1.7	1,923.5	444.0	26.3	470.3	1,949.8	163.1	75.4
1958	1,394.2	466.2	−55.6	94.7	− 5.8	1,893.7	404.7	26.5	431.2	1,920.2	179.6	84.2
1959	1,423.1	480.1	−83.0	85.5	2.4	1,908.1	399.5	27.7	427.2	1,935.8	183.0	85.3
1960	1,429.3	456.6	−61.4	80.7	− 1.9	1,903.4	393.3	27.2	420.5	1,930.6	182.4	88.1
1961	1,444.5	405.6	−39.7	79.6	3.2	1,893.2	369.1	31.0	400.1	1,924.3	191.1	91.6

TABLE C–5

TOTAL NATIONAL CONSUMPTION AND SELECTED COMPONENTS

	1	2	3	4	5	6	7	8	9	10	11
	Total Private Consumption								Public Consumption of Services: Admin., Welfare, Health, Education, etc.	National Consumption of Services	Total National Consumption
			Services								
Year	Non-Durable Goods	Durable Goods	Total Services	Medical Services	Recreation	Canadian Tourist Expenditures Abroad	Remaining Services	Total Private Consumption			
Symbol	C_{nd}	C_d	C_s 4+5+6+7					C 1+2+3	C_g	$C^n_s = C_s + C_g$	C^n 8+9
Units	m57$										m57$
1926	3,345	575	2,852	326	288	181	2,057	6,772	773	3,625	7,545
1927	3,867	685	2,982	341	304	186	2,152	7,534	800	3,782	8,334
1928	4,351	827	3,100	355	318	184	2,242	8,277	809	3,909	9,086
1929	4,668	873	3,227	363	325	202	2,336	8,768	908	4,135	9,676
1930	4,534	726	3,118	346	296	177	2,300	8,378	993	4,111	9,371
1931	4,505	614	2,816	334	258	142	2,082	7,935	1,059	3,875	8,994
1932	4,320	456	2,535	281	202	100	1,952	7,311	1,034	3,569	8,345
1933	4,203	425	2,498	262	195	99	1,942	7,126	845	3,343	7,971
1934	4,357	520	2,605	272	216	120	1,997	7,482	890	3,495	8,372
1935	4,467	595	2,738	314	240	149	2,036	7,799	921	3,659	8,720
1936	4,666	655	2,834	331	265	173	2,065	8,155	930	3,764	9,085
1937	4,961	746	2,962	351	296	193	2,122	8,669	919	3,881	9,588
1938	4,848	662	3,044	370	306	192	2,176	8,554	1,032	4,076	9,586
1939	5,029	689	3,071	369	310	177	2,214	8,788	1,029	4,100	9,817
1940	5,377	813	3,311	405	340	88	2,478	9,500	1,092	4,403	10,592

TABLE C–5 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11
1941	5,819	793	3,487	420	382	41	2,644	10,099	1,176	4,663	11,275
1942	6,102	618	3,671	412	425	46	2,788	10,392	1,032	4,703	11,424
1943	6,455	537	3,677	422	454	60	2,741	10,669	836	4,513	11,505
1944	6,832	578	4,003	429	486	94	2,993	11,414	754	4,757	12,168
1945	7,529	663	4,335	463	533	131	3,207	12,527	962	5,297	13,489
1946	8,343	983	4,620	512	586	208	3,314	13,946	1,128	5,748	15,074
1947	8,757	1,298	4,047	503	569	218	2,758	14,102	1,543	5,590	15,645
1948	8,453	1,258	4,118	502	562	165	2,890	13,829	1,583	5,701	15,412
1949	8,516	1,515	4,422	524	583	231	3,085	14,454	1,737	6,159	16,191
1950	8,906	1,893	4,606	553	597	249	3,207	15,405	1,685	6,291	17,090
1951	9,080	1,718	4,840	563	599	298	3,381	15,637	1,723	6,563	17,360
1952	9,540	2,018	5,159	577	624	382	3,576	16,717	1,883	7,042	18,600
1953	10,006	2,297	5,347	606	614	405	3,723	17,650	1,851	7,198	19,501
1954	10,195	2,262	5,462	635	556	428	3,843	17,920	1,917	7,379	19,837
1955	10,808	2,645	5,316	645	504	477	3,690	18,770	2,204	7,520	20,974
1956	10,037	2,530	6,911	889	589	446	4,987	19,478	2,651	9,562	22,129
1957	10,441	2,430	7,201	912	582	473	5,234	20,072	2,706	9,907	22,778
1958	10,686	2,464	7,557	1,004	580	475	5,498	20,707	3,062	10,619	23,769
1959	11,070	2,593	7,967	1,089	588	525	5,765	21,630	3,192	11,159	24,822
1960	11,396	2,584	8,232	1,170	584	535	5,943	22,212	3,250	11,482	25,462
1961	11,724	2,676	8,459	1,261	567	513	6,118	22,859	3,486	11,945	26,345

TABLE C-6

PERCENTAGE DISTRIBUTION OF CANADIAN CONSUMPTION

	1	2	3	4	5	6	7	8	9
	Private Consumption								
			Services						
Year	Non-Durable Goods	Durable Goods	Total Services	Medical Services	Recreation	Canadian Tourist Expenditure Abroad	Remaining Services	Total Private Consumption	Public Services Consumed, as Per Cent of National Consumption
Symbol	C^o_{nd}	C^o_d	C^o_s					C^o	$(C_g/C^n)x100$
Units	%	%	%	%	%	%	%	%	%
1926..............	49.4	8.5	42.1	4.8	4.3	2.7	30.4	100.0	10.2
1927..............	51.3	9.1	39.6	4.5	4.0	2.5	28.6	100.0	9.6
1928..............	52.6	10.0	37.4	4.3	3.8	2.2	27.1	100.0	8.9
1929..............	53.2	10.0	36.8	4.1	3.7	2.3	26.6	100.0	9.4
1930..............	54.1	8.7	37.2	4.1	3.5	2.1	27.4	100.0	10.6
1931..............	56.8	7.7	35.5	4.2	3.2	1.8	26.2	100.0	11.8
1932..............	59.1	6.2	34.7	3.8	2.8	1.4	26.7	100.0	12.4
1933..............	59.0	6.0	35.0	3.7	2.7	1.4	27.3	100.0	10.6
1934..............	58.2	7.0	34.8	3.6	2.9	1.6	26.7	100.0	10.6
1935..............	57.3	7.6	35.1	4.0	3.1	1.9	26.1	100.0	10.6
1936..............	57.2	8.0	34.7	4.1	3.3	2.1	25.3	100.0	10.2
1937..............	57.2	8.6	34.2	4.0	3.4	2.2	24.5	100.0	9.6
1938..............	56.7	7.7	35.6	4.3	3.6	2.2	25.4	100.0	10.8
1939..............	57.2	7.8	34.9	4.2	3.5	2.0	25.2	100.0	10.5
1940..............	56.6	8.6	34.8	4.3	3.6	0.9	26.1	100.0	10.3

TABLE C–6 (Concl.)

Year	1	2	3	4	5	6	7	8	9
1941	57.6	7.8	34.5	4.2	3.8	0.4	26.2	100.0	10.4
1942	58.7	6.0	35.3	4.0	4.1	0.4	26.8	100.0	9.0
1943	60.5	5.0	34.5	4.0	4.3	0.6	25.7	100.0	7.3
1944	59.9	5.1	35.1	3.8	4.3	0.8	26.2	100.0	6.2
1945	60.1	5.3	34.6	3.7	4.3	1.0	25.6	100.0	7.1
1946	59.8	7.1	33.1	3.7	4.2	1.5	23.8	100.0	7.5
1947	62.1	9.2	28.7	3.6	4.0	1.5	19.6	100.0	9.9
1948	61.1	9.1	29.8	3.6	4.1	1.2	20.9	100.0	10.3
1949	58.9	10.5	30.6	3.6	4.0	1.6	21.3	100.0	10.7
1950	57.8	12.3	29.9	3.6	3.9	1.6	20.8	100.0	9.9
1951	58.1	11.0	31.0	3.6	3.8	1.9	21.6	100.0	9.9
1952	57.1	12.1	30.9	3.5	3.7	2.3	21.4	100.0	10.1
1953	56.7	13.0	30.3	3.4	3.5	2.3	21.1	100.0	9.5
1954	56.9	12.6	30.5	3.5	3.1	2.4	21.4	100.0	9.7
1955	57.6	14.1	28.3	3.4	2.7	2.5	19.7	100.0	10.5
1956	51.5	13.0	35.5	4.6	3.0	2.3	25.6	100.0	12.0
1957	52.0	12.1	35.9	4.5	2.9	2.4	26.1	100.0	11.9
1958	51.6	11.9	36.5	4.8	2.8	2.3	26.6	100.0	12.9
1959	51.2	12.0	36.8	5.0	2.7	2.4	26.7	100.0	12.9
1960	51.3	11.6	37.1	5.3	2.6	2.4	26.8	100.0	12.8
1961	51.3	11.7	37.0	5.5	2.5	2.2	26.8	100.0	13.2

SECTION D – INCOME DISTRIBUTION TO FACTORS OF PRODUCTION

TABLE D–1

THE INCOME SIDE OF THE ECONOMY: EARNED INCOMES AND DISPOSABLE INCOMES

	1	2	3	4	5	6	7	8	9	10	11	12
								Disposable Income				
Year	Wage and Salary Incomes, Including Defence	Property and Enterprise Incomes of Residents	Capital Gains on Inventories	Indirect Taxes Less Subsidies	Capital Cons. and Misc. Val. Adjust.	Residual Error of Estimate	Gross National Product	Private Disposable Income	Gross Private Disposable Income	Government Disposable Income	Undistributed Corpor. and Wheat Board Profits	Personal Disposable Income
Symbol	W_m	π_m	J_m	$T_{i-s,m}$	D_m	$+\frac{1}{2}R_{1m}$	GNP_m	Y_m	$Y_m + D_m$	Y_{gm}	$\pi_{cum} + \pi_{um}^{a}$	Y_{pm}
Units	mc$						1+2−3+4+5+6 or 9+10−3+6					8−11
1926	2,373	1,710	−46	612	567	−156	5,152	4,167	4,734	528	206	3,961
1927	2,513	1,814	−29	634	611	−52	5,549	4,399	5,010	562	224	4,175
1928	2,722	2,014	−1	679	671	−41	6,046	4,788	5,459	627	293	4,495
1929	2,948	1,775	15	681	717	28	6,134	4,772	5,489	632	232	4,540
1930	2,794	1,366	−239	593	711	25	5,728	4,273	4,984	480	6	4,267
1931	2,416	794	−172	557	646	114	4,699	3,410	4,056	357	−142	3,552
1932	1,983	549	−109	537	576	73	3,827	2,782	3,358	287	−169	2,951
1933	1,796	594	22	537	528	77	3,510	2,657	3,185	270	−64	2,721
1934	1,947	875	39	578	522	101	3,984	3,101	3,623	299	31	3,070
1935	2,088	1,031	20	585	531	100	4,315	3,349	3,880	355	81	3,268
1936	2,250	1,153	36	660	555	71	4,653	3,570	4,125	493	118	3,452
1937	2,547	1,427	87	705	594	71	5,257	4,111	4,705	568	216	3,895
1938	2,524	1,410	−67	639	604	34	5,278	4,073	4,677	500	120	3,953
1939	2,633	1,659	56	734	637	29	5,636	4,403	5,040	623	225	4,178
1940	3,152	2,032	121	831	750	99	6,743	4,981	5,731	1,034	206	4,775

TABLE D-1 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941	3,994	2,467	156	1,055	893	75	8,328	5,836	6,729	1,680	281	5,555
1942	4,923	3,297	122	1,086	1,043	100	10,327	7,216	8,259	2,090	318	6,898
1943	5,722	3,163	83	1,118	1,037	131	11,088	7,625	8,662	2,378	281	7,344
1944	6,066	3,569	52	1,112	1,005	150	11,850	8,354	9,359	2,393	327	8,027
1945	6,154	3,548	37	1,004	968	198	11,835	8,757	9,725	1,949	446	8,311
1946	5,827	3,978	254	1,270	998	31	11,850	9,433	10,431	1,642	510	8,923
1947	6,482	4,450	571	1,608	1,223	-27	13,165	10,246	11,469	2,294	662	9,584
1948	7,496	5,013	506	1,765	1,441	-89	15,120	11,769	13,210	2,505	690	11,079
1949	8,115	4,902	112	1,808	1,673	-43	16,343	12,325	13,998	2,500	476	11,849
1950	8,766	5,769	374	2,000	1,913	-68	18,006	13,606	15,519	2,929	918	12,688
1951	10,304	6,927	643	2,469	2,203	-90	21,170	15,444	17,647	4,256	650	14,794
1952	11,478	7,070	-106	2,717	2,422	202	23,995	16,733	19,155	4,532	661	16,072
1953	12,419	6,886	11	2,911	2,673	142	25,020	17,609	20,282	4,607	705	16,904
1954	12,799	6,147	-86	2,947	2,905	-13	24,871	17,563	20,468	4,330	579	16,984
1955	13,617	7,309	189	3,237	3,266	-108	27,132	19,265	22,531	4,898	1,026	18,239
1956	15,314	8,090	238	3,636	3,642	141	30,585	21,304	24,946	5,736	1,151	20,153
1957	16,494	7,595	78	3,861	4,009	28	31,909	22,128	26,137	5,822	854	21,274
1958	17,012	8,034	35	3,882	3,899	102	32,894	23,755	27,654	5,173	875	22,880
1959	17,959	8,588	130	4,251	4,159	-43	34,784	24,869	29,028	5,929	984	23,885
1960	18,628	8,581	55	4,446	4,293	35	35,928	25,620	29,913	6,035	799	24,821
1961	19,434	8,565	86	4,643	4,349	-61	36,844	26,352	30,701	6,290	807	25,545

TABLE D-2

PERCENTAGE DISTRIBUTION OF DISPOSABLE INCOMES: GOVERNMENT SURPLUS OR DEFICIT, NATIONAL ACCOUNTS BASIS

	1	2	3	4	5	6	7	8	9	10	11	12
	Percentage Distribution of Disposable Incomes											
Year	Private Dispos. Incomes	Capital Cons. Allow. and Misc. Val. Adjust.	Gross Priv. Dispos. Incomes	Capital Gains on Invent-ories	Govern-ment Dispos. Inc.	Resid. Error of Estim.	Gross National Product	Govern-ment Dispos. Inc.	Govern-ment Expend-itures on Goods and Services	Govern-ment Surplus + or Deficit −	Govern-ment Revenue	Govern-ment Transfer Payments Plus Subsidies
Symbol	Y^o_m	D^o_m	$(Y + D)^o_m$	J^o_m	Y^o_{gm}	$+\frac{1}{2}R^o_{1m}$	GNP^o_m	Y_{gm}	G_m	S_{gm}	$T^{\bullet}_m$	$Tr_m + T_s$
Units	%	%	%	%	%	%	%	11–12 mc$	mc$	8–9 mc$	mc$	mc$
1926	80.9	11.0	91.9	−0.9	10.2	−3.0	100.0	528	488	40	835	307
1927	79.3	11.0	90.3	−0.5	10.1	−0.9	100.0	562	531	31	876	314
1928	79.2	11.1	90.3	−0.02	10.4	−0.7	100.0	627	560	67	950	323
1929	77.8	11.7	89.5	0.2	10.3	0.5	100.0	632	640	−8	965	333
1930	74.6	12.4	87.0	−4.2	8.4	0.4	100.0	480	721	−241	843	363
1931	72.6	13.7	86.3	−3.7	7.6	2.4	100.0	357	688	−331	769	412
1932	72.7	15.1	87.8	−2.8	7.5	1.9	100.0	287	584	−297	731	444
1933	75.7	15.0	90.7	0.6	7.7	2.2	100.0	270	462	−192	742	472
1934	77.8	13.1	90.9	1.0	7.5	2.5	100.0	299	503	−204	811	512
1935	77.6	12.3	89.9	0.5	8.2	2.3	100.0	355	542	−187	879	524
1936	76.7	11.9	88.6	0.8	10.6	1.5	100.0	493	544	−51	1,008	515
1937	78.2	11.3	89.5	1.7	10.8	1.4	100.0	568	619	−51	1,088	520
1938	77.2	11.4	88.6	−1.3	9.5	0.6	100.0	500	666	−166	1,054	554
1939	78.1	11.3	89.4	1.0	11.1	0.5	100.0	623	683	−60	1,110	487
1940	73.9	11.1	85.0	1.8	15.3	1.5	100.0	1,034	1,116	−82	1,567	533

TABLE D–2 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941.......	70.1	10.7	80.8	1.9	20.2	0.9	100.0	1,680	1,635	45	2,239	559
1942.......	69.9	10.1	80.0	1.2	20.2	1.0	100.0	2,090	-3,674	-1,584	2,715	625
1943.......	68.8	9.4	78.2	0.7	21.4	1.2	100.0	2,378	4,177	-1,799	3,170	792
1944.......	70.5	8.5	79.0	0.4	20.2	1.3	100.0	2,393	4,978	-2,585	3,342	949
1945.......	74.0	8.2	82.2	0.3	16.5	1.7	100.0	1,949	3,656	-1,707	3,269	1,320
1946.......	79.6	8.4	88.0	2.1	13.9	0.3	100.0	1,642	1,796	-154	3,538	1,896
1947.......	77.8	9.3	87.1	4.3	17.4	-0.2	100.0	2,294	1,541	753	3,869	1,575
1948.......	77.8	9.5	87.3	3.3	16.6	-0.6	100.0	2,505	1,797	708	4,000	1,495
1949.......	75.4	10.2	85.6	0.7	15.3	-0.3	100.0	2,500	2,127	373	4,097	1,597
1950.......	75.6	10.6	86.2	2.1	16.3	-0.4	100.0	2,929	2,344	585	4,567	1,638
1951.......	73.0	10.4	83.4	3.0	20.1	-0.4	100.0	4,256	3,271	985	5,969	1,713
1952.......	69.7	10.1	79.8	-0.4	18.9	0.8	100.0	4,532	4,279	253	6,571	2,039
1953.......	70.4	10.7	81.1	0.04	18.4	0.6	100.0	4,607	4,432	175	6,788	2,181
1954.......	70.6	11.7	82.3	-0.3	17.4	-0.1	100.0	4,330	4,461	-131	6,719	2,389
1955.......	71.0	12.0	83.0	0.7	18.1	-0.4	100.0	4,898	4,792	106	7,386	2,488
1956.......	69.7	11.9	81.6	0.8	18.8	0.5	100.0	5,736	5,386	350	8,339	2,603
1957.......	69.3	12.6	81.9	0.2	18.2	0.1	100.0	5,822	5,722	100	8,753	2,931
1958.......	72.2	11.9	84.1	0.1	15.7	0.3	100.0	5,173	6,180	-1,007	8,738	3,565
1959.......	71.5	12.0	83.5	0.4	17.0	-0.1	100.0	5,929	6,449	-520	9,843	3,914
1960.......	71.3	11.9	83.2	0.2	16.8	0.1	100.0	6,035	6,683	-648	10,470	4,435
1961.......	71.5	11.8	83.3	10.2	17.1	-0.2	100.0	6,290	7,183	-893	11,009	4,719

SECTION E – IMPORTANT RATIOS RELATED TO GROWTH, AND SOME IMPORTANT GROWTH RATES

TABLE E–1

"GREAT RATIOS" AND GROWTH RATES RELATED TO LONG-RUN ECONOMIC CHANGE

	1	2	3	4	5	6	7	8	9	10	11	12
					Capital-Output Ratios							
Year	Savings Ratio	Average Real Output per Constant Dollar of Capital	Equil. or "Warranted" Growth Rate	Actual Growth Rate of GDP	Stock of Machinery and Equipment	Stock of Dwellings, Plant and Construction	Stock of Total Fixed Reprod. Capital	Inventory Stocks	Total Reprod. Tangible Capital	Capital per Man-Hour	Average Real Output Per Man-Hour	Average Hourly Earnings —Real
Symbol	$s = GI^n/GDP$	$PK = GDP/K$	s_{PK}	$\dot{}GDP$	K^n_M/GDP	K^n_{dPC}/GDP	K^n_{dPCM}/GDP	H_j/GDP	K/GDP	K/N_eh	$PL = GDP_c/N_eh$	w_{hr}
Units	ratio r	r	r	r	r	r	r	r	r	1—57$/m-h	1—57$/m-h	1—57$/m-h
1926	.1924	.2163	.04162		.4754	3.6937	4.1691	.4535	4.6226	4.8223	1.0416	.7478
1927	.2276	.2335	.05314	.08911	.4510	3.3818	3.8328	.4504	4.2832	4.7556	1.1087	.7824
1928	.2299	.2508	.05766	.09322	.4333	3.1079	3.5413	.4464	3.9877	4.6972	1.1764	.8143
1929	.2333	.2482	.05791	.008981	.4583	3.1082	3.5666	.4619	4.0285	4.6852	1.1613	.8565
1930	.2287	.2376	.05434	−.03256	.4874	3.2275	3.7150	.4938	4.2088	4.9314	1.1700	.8961
1931	.1390	.2123	.02951	−.1129	.5313	3.6248	4.1561	.5540	4.7101	5.3110	1.1257	.9007
1932	.08821	.1983	.01749	−.09119	.5436	3.9175	4.4611	.5825	5.0436	5.5908	1.1064	.9204
1933	.05653	.1901	.01075	−.07063	.5392	4.1188	4.6579	.6018	5.2597	5.5160	1.0466	.9240
1934	.1024	.2146	.02198	.1024	.4611	3.6629	4.1240	.5350	4.6590	5.0094	1.0733	.8840
1935	.1200	.2330	.02796	.06984	.4150	3.3690	3.7840	.5080	4.2920	4.8038	1.1172	.9280
1936	.09680	.2473	.02394	.04736	.3898	3.1750	3.5648	.4787	4.0435	4.6170	1.1398	.9445
1937	.1507	.2702	.04072	.08794	.3696	2.8997	3.2692	.4324	3.7016	4.3488	1.1729	.9934
1938	.1588	.2735	.04343	.01202	.3739	2.8400	3.2139	.4424	3.6563	4.3632	1.1914	.9905
1939	.1807	.2920	.05276	.07458	.3518	2.6212	2.9730	.4520	3.4250	4.2920	1.2463	1.0184
1940	.1679	.3269	.05489	.1367	.3297	2.2822	2.6119	.4472	3.0591	4.2028	1.3390	1.0390

TABLE E-1 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12
1941.......	.1287	.3651	.04699	.1322	.3179	2.0028	2.3207	.4183	2.7391	3.9924	1.3871	.9776
1942.......	.1181	.4266	.05038	.1764	.2838	1.6936	1.9774	.3666	2.3440	3.8855	1.5630	1.0319
1943.......	.06890	.4427	.03050	.03469	.2714	1.6324	1.9038	.3550	2.2588	3.9189	1.5762	1.1001
1944.......	.07996	.4604	.03681	.03450	.2726	1.5692	1.8418	.3301	2.1719	3.9744	1.6532	1.1101
1945.......	.07771	.4498	.03495	-.02578	.2950	1.6068	1.9017	.3213	2.2230	4.1679	1.7136	1.1459
1946.......	.1630	.4347	.07086	-.01448	.3215	1.6507	1.9722	.3280	2.3002	4.1371	1.7519	1.2243
1947.......	.2130	.4186	.08916	.01425	.3646	1.6725	2.0371	.3516	2.3888	4.3375	1.8051	1.2722
1948.......	.2059	.4042	.08322	.01544	.4085	1.7025	2.1110	.3629	2.4740	4.4993	1.8079	1.2671
1949.......	.2124	.4011	.08519	.04052	.4377	1.7025	2.1402	.3529	2.4930	4.6780	1.8636	1.2876
1950.......	.2369	.4080	.09666	.07158	.4479	1.6567	2.1046	.3464	2.4510	4.9596	2.0083	1.3474
1951.......	.2480	.4058	.1006	.05515	.4662	1.6322	2.0984	.3658	2.4641	5.2693	2.1166	1.3873
1952.......	.2312	.4108	.09498	.07495	.4751	1.5857	2.0608	.3733	2.4341	5.5183	2.2384	1.4102
1953.......	.2427	.4023	.09764	.03735	.4988	1.6013	2.1000	.3856	2.4856	5.7719	2.2914	1.4864
1954.......	.2055	.3745	.07696	-.02736	.5416	1.7230	2.2646	.4056	2.6701	6.0682	2.2386	1.4940
1955.......	.2388	.3883	.09273	.08602	.5265	1.6710	2.1975	.3780	2.5755	6.2524	2.3908	1.5238
1956.......	.2893	.3928	.1136	.08660	.5268	1.6456	2.1724	.3736	2.5460	6.4499	2.4971	1.5497
1957.......	.2726	.3726	.1016	.01452	.5587	1.7366	2.2953	.3886	2.6839	6.8295	2.5073	1.5907
1958.......	.2428	.3591	.08719	.01206	.5736	1.8287	2.4023	.3827	2.7850	7.2725	2.5735	1.6194
1959.......	.2480	.3550	.08804	.03146	.5776	1.8685	2.4461	.3712	2.8173	7.3982	2.5891	1.6122
1960.......	.2365	.3477	.08223	.01854	.5862	1.9159	2.5021	.3740	2.8761	7.6157	2.6116	1.6244
1961.......	.2108	.3439	.07249	.02047	.5816	1.9587	2.5403	.3675	2.9078	7.7818	2.6396	1.6670

TABLE E–2

"GREAT RATIOS" AND GROWTH RATES RELATED TO LONG-RUN ECONOMIC CHANGE

	1	2	3	4	5	6	7	8	9	10	11	12	13
Year	National Average Propensity to Consume		Private Sector Consumption Ratio	Ratio of Property — Enterprise Income to Tangible Reproducible Capital	Labour Share of Output	Capital Share of Output	Rates of Growth — Productive Factors and Real Output						Technical Progress
	Civilian	Defence					Man-Hours	Capital in Use	Combined Factor Inputs	Gross Domestic Prod.—Civil.	Technical Progress: Approx.	Technical Progress: Adj. for Finite Chgs.	
Symbol	$C^{no} = C^n/GNE \times 100$	$G^o_M = G_M/GNE \times 100$	$(C/Y) \times 100$	r	y_L	y_K	$^{\bullet}N_e h = {}^{\bullet}L$	$^{\bullet}K_p$	$y_L {}^{\bullet}N_e h + y_K {}^{\bullet}K_p$	$^{\bullet}GDP_c$	$^{\bullet}A+$	$^{\bullet}A$	A
Units	%	%	%	%	r	r	r	r	r	r	r	r	r
1926	75.1	0.3	84.3	7.8	.47829	.52171							1.000
1927	76.1	0.4	87.8	8.2	.47850	.52150	.02331	.01014	.01644	.08924	.07280	.07162	1.072
1928	75.9	0.4	88.1	8.9	.47725	.52275	.03044	.02334	.02673	.09336	.06663	.06490	1.141
1929	80.6	0.4	94.5	7.8	.51399	.48601	.02192	.01839	.02020	.008830	-.01137	-.01114	1.128
1930	81.5	0.5	98.7	7.4	.51160	.48840	-.03973	-.03132	-.03562	-.03260	.00302	.00313	1.132
1931	89.7	0.4	110.1	5.4	.54904	.45096	-.07818	-.06042	-.07017	-.1131	-.04293	-.04617	1.080
1932	92.7	0.4	111.7	4.6	.56164	.43836	-.07554	-.08136	-.07809	-.09134	-.01325	-.01437	1.064
1933	94.6	0.6	111.9	4.2	.56727	.43273	-.01766	-.04508	-.02953	-.07076	-.04123	-.04248	1.019
1934	88.7	0.6	102.1	5.4	.54932	.45068	.07529	.005404	.04379	.1026	.05881	.05634	1.076
1935	85.8	0.6	99.0	6.3	.54136	.45864	.02773	-.009830	.01050	.06976	.05926	.05864	1.140
1936	85.5	0.5	100.4	6.8	.53700	.46300	.02666	-.009249	.01003	.04745	.03742	.03705	1.182
1937	82.1	0.6	94.6	6.4	.54472	.45528	.05736	.01986	.04029	.08810	.04781	.04596	1.236
1938	81.5	0.7	94.1	8.5	.52154	.47846	-.00375	-.01259	-.007940	.01204	.01998	.02014	1.261
1939	77.7	1.3	88.9	9.2	.51186	.48814	.02329	.01320	.01836	.07047	.05211	.05117	1.325
1940	73.2	7.7	88.5	10.2	.50538	.49462	.03680	.04562	.04116	.1139	.07274	.06986	1.418

TABLE E–2 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
1941.......	68.1	12.6	86.8	10.8	.51781	.48219	.06724	.09332	.07982	.1056	.02578	.02387	1.452
1942.......	58.2	28.9	75.5	13.7	.49349	.50651	.03446	.01972	.02699	.1656	.13861	.13497	1.472
1943.......	56.6	31.4	75.9	12.9	.53971	.46029	-.01144	-.002943	-.007529	.003075	.00445	.00449	1.478
1944.......	57.7	34.7	76.5	14.2	.52388	.47612	-.01920	-.005305	-.01258	.02872	.04130	.04183	1.540
1945.......	65.5	22.3	82.1	13.8	.51783	.48217	-.04914	-.002838	-.02681	-.01442	.01239	.01273	1.560
1946.......	74.6	6.8	86.4	14.2	.52866	.47134	.02732	.007483	.01797	.05030	.03233	.03176	1.609
1947.......	76.5	1.7	88.8	12.9	.54163	.45837	.004637	.06248	.03115	.03516	.00401	.00389	1.615
1948.......	74.0	1.6	85.4	12.5	.54353	.45647	.01385	.05077	.03070	.01539	-.01531	-.01485	1.591
1949.......	74.9	2.2	88.6	12.3	.54162	.45838	.008504	.03948	.02270	.03958	.01688	.01651	1.618
1950.......	73.9	2.7	87.9	12.8	.53138	.46862	-.006303	.05078	.02045	.07089	.04749	.04654	1.693
1951.......	70.7	5.3	86.9	12.5	.53942	.46058	-.001543	.07102	.03188	.05228	.02040	.01977	1.726
1952.......	70.2	7.4	90.1	12.6	.53625	.46375	.01391	.06005	.03531	.07227	.03696	.03570	1.788
1953.......	70.9	7.4	90.6	11.4	.55917	.44083	.01278	.05844	.03291	.03677	.00386	.00374	1.795
1954.......	74.3	6.9	94.6	9.7	.57236	.42764	-.006186	.03139	.009883	-.02911	-.04607	-.04562	1.713
1955.......	72.3	6.7	90.9	10.5	.55570	.44430	.01666	.04831	.03072	.08579	.05507	.05343	1.804
1956.......	70.2	6.0	88.8	10.4	.55648	.44352	.04129	.08352	.06002	.08759	.02757	.02601	1.851
1957.......	71.4	5.5	90.7	9.2	.57246	.42754	.01001	.05833	.03067	.01413	-.01654	-.01605	1.822
1958.......	73.6	5.0	88.8	9.1	.57224	.42776	-.01377	.02776	.003995	.01230	-.00745	-.00742	1.808
1959.......	74.6	4.5	90.8	9.0	.57151	.42849	.02569	.05257	.03721	.03190	-.00531	-.00512	1.799
1960.......	75.1	4.2	91.7	8.6	.57741	.42259	.01011	.03036	.01867	.01886	.00019	.00019	1.799
1961.......	76.3	4.2	92.4	8.3	.58533	.41467	.009701	.02964	.01797	.02055	.00258	.00253	1.804

SECTION F – GROSS DOMESTIC PRODUCT AND REAL DISPOSABLE INCOMES

TABLE F–1

GROSS DOMESTIC PRODUCT: DISPOSABLE INCOMES IN REAL TERMS

	1	2	3	4	5	6	7	8	9	10	11	12	13
	Gross Domestic Product					Real Disposable Incomes Adding Up to GNP = 9+10+11+12+13							
Year	Interest and Dividends Paid Abroad	Interest and Dividends Received from Abroad	Gross Domestic Product	Defence Value Added to GDP	Gross Domestic Product – Civilian	Personal Disposable Income	Undistributed Corporation Profits	Undistributed Wheat Board Trading Profits	Disposable Income Private Sector	Government Disposable Income	Capital Cons. Allow. and Misc. Val. Adjustments	Inventory Valuation Adj.=neg. of Cap. Gains	Residual Error
Symbol	π_{di}	π_{id}	GDP	G_{MI}	GDP_c	Y_p	π_{cu}	π_u^a	Y	Y_g	D	–J	+½R_1
Units	m57$	m57$	m57$	m57$	3–4 m57$	m57$	m57$	m57$	6+7+8 m57$	m57$	m57$	m57$	m57$
1926	394	56	10,381	16	10,365	7,599	413	23	8,035	1,013	1,206	88	–299
1927	432	74	11,306	16	11,290	8,100	498	–14	8,584	1,090	1,318	56	–101
1928	477	83	12,360	16	12,344	8,770	590	31	9,391	1,223	1,430	2	–80
1929	574	113	12,471	18	12,453	8,794	479	2	9,275	1,224	1,485	–29	54
1930	687	117	12,065	18	12,047	8,478	4	8	8,490	954	1,527	475	50
1931	782	108	10,703	18	10,685	7,505	–251	–49	7,205	754	1,466	363	241
1932	809	88	9,727	18	9,709	6,943	–372	–26	6,545	675	1,358	256	172
1933	705	95	9,040	18	9,022	6,519	–84	–69	6,366	647	1,286	–53	184
1934	660	133	9,966	18	9,948	7,256	125	–50	7,331	707	1,254	–92	239
1935	651	151	10,662	20	10,642	7,685	202	–9	7,878	835	1,261	–47	235
1936	716	171	11,167	20	11,147	7,847	339	–61	8,125	1,121	1,297	–82	161
1937	631	164	12,149	20	12,129	8,693	484	–16	9,161	1,268	1,289	–194	158
1938	685	149	12,295	20	12,275	8,830	252	11	9,093	1,117	1,323	150	76
1939	712	128	13,212	72	13,140	9,394	605	–112	9,887	1,401	1,401	–126	65
1940	660	104	15,018	381	14,637	10,300	358	71	10,729	2,230	1,550	–261	214

TABLE F–1 (Concl.)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
1941........	574	115	17,004	822	16,182	11,101	538	-	11,639	3,357	1,711	–312	150
1942........	502	117	20,004	1,142	18,862	13,191	664	–90	13,765	3,997	1,899	–233	191
1943........	464	99	20,698	1,894	18,804	13,586	569	–92	14,063	4,399	1,783	–154	242
1944........	437	115	21,412	2,068	19,344	14,375	591	–39	14,927	4,285	1,703	–93	269
1945........	401	128	20,860	1,795	19,065	14,498	640	122	15,260	3,400	1,647	–65	345
1946........	450	104	20,558	534	20,024	15,298	802	38	16,138	2,815	1,641	–435	53
1947........	511	99	20,851	123	20,728	14,830	995	53	15,878	3,550	1,937	–884	–42
1948........	447	95	21,173	126	21,047	15,225	1,101	–137	16,189	3,442	2,008	–695	–122
1949........	515	110	22,031	151	21,880	15,679	777	–147	16,309	3,308	2,214	–148	–57
1950........	601	111	23,608	177	23,431	16,361	941	214	17,516	3,777	2,395	–482	–88
1951........	493	125	24,910	254	24,656	17,280	730	–14	17,996	4,971	2,431	–751	–105
1952........	441	165	26,777	339	26,438	17,838	659	48	18,545	5,030	2,584	118	224
1953........	448	187	27,777	367	27,410	18,751	758	–27	19,482	5,110	2,778	–12	158
1954........	473	167	27,017	405	26,612	18,333	594	9	18,936	4,674	3,023	93	–14
1955........	510	175	29,341	446	28,895	19,574	1,007	69	20,650	5,257	3,418	–203	–116
1956........	519	145	31,882	456	31,426	20,742	1,171	21	21,934	5,904	3,771	–245	145
1957........	589	153	32,345	475	31,870	20,274	854	-	22,128	5,822	4,009	–78	28
1958........	617	166	32,735	473	32,262	22,467	857	–1	23,323	5,080	3,815	–34	100
1959........	667	183	33,765	474	33,291	22,874	941	–5	23,810	5,678	3,959	–124	–41
1960........	659	175	34,391	472	33,919	23,477	738	6	24,221	5,708	3,997	–52	33
1961........	753	187	35,095	479	34,616	24,000	719	26	24,745	5,910	4,012	–81	–57

APPENDIX B

SOURCES AND EXPLANATIONS FOR THE BASIC HISTORICAL DATA AND THE PROJECTED DATA

Purpose

In this appendix we shall describe how the data in Appendix A (Basic Historical Data) were obtained and processed. Following this we shall explain how the calculations for the projections PR–1, 2 and 3 were made, wherever this is not obvious.

In the description of sources and processing it will be seen how the attempt has been made to obtain data which correspond to the concepts of the economic theory which we presented. A further purpose in this description is to help subsequent researchers in this field to improve the processing formulas presented, and to facilitate their work in the adjusting and carrying forward of the data, incorporating any subsequent revisions and modifications in concepts made by the Dominion Bureau of Statistics (DBS).

Recent Revisions and Observations of Economic Data by DBS

The basic historical data for this projection were completed around August 1962. At that time the terminal year of available data was 1961, and these data were of course subject to subsequent revision. With the data completed up to and including 1961, we immediately went into Projections One and Two. Following this, in the late summer, we set up the econometric growth model of Chapter 9, and proceeded to fit it to the basic historical data, as completed at that time. These are the data which we present in Appendix A, and in PR–1, 2 and 3.

Since then we have had the observed data for 1962, and with it revisions of the data for 1959 to 1961. Ideally one would have liked to have prepared revisions of the basic historical data, followed by corresponding revisions in the three growth models, and in the three projections. For a larger organization, operating on a continuing basis, this is what would be done periodically. However, in the case of this project, with limited resources available and the time limitations,

as prescribed by the Royal Commission on Health Services which has sponsored this study, such revisions could not be made. Hence the historical data and the models appear as they were completed in the late summer and into the autumn of 1962.

Publication Sources

All of the primary data come from publications of the Dominion Bureau of Statistics, unless otherwise specified.

Reference Procedure

We shall refer here to the data of this study by table number and column number. Wherever a column is derived from other columns in the table, and the process is adequately implied in the word description and symbol for the column, no explanation for that column will appear.

BASIC HISTORICAL DATA

Section A – Population and Employment

TABLE A–1

Column Number	PUBLICATION AND EXPLANATIONS
1	*Population of Canada by Provinces, 1921–1960; Daily Bulletin,* March 9, 1962, 1. Population of Canada, Census, June 1, 1961.
2	From 1945 to 1961 the civilian labour force was derived from *The Labour Force* publications and DBS Reference Paper No. 58 (Revised) of the Special Surveys Division of DBS. From 1953 to 1961 the average of twelve monthly surveys was used to obtain an annual average. From 1945 to 1952 quarterly surveys were converted to monthly estimates using a seasonal pattern. Again the twelve months were averaged. Newfoundland data for the full year 1949 were estimated and added in, to correspond to the National Accounts for that year. An adjustment was made to the estimates for 1950 to include Manitoba in the June survey. It had been omitted because of the disastrous flood in that year.

To obtain the total Canadian labour force N_1, estimates of the labour force in the Yukon and the Northwest Territories (YNT) were added to the data, to make them more comparable to the National Accounts data; and finally the numbers in the armed forces, N_M were added in. These latter data for 1946 to 1961 were obtained from *Bank of Canada Statistical Summary, Supplement,* 1960, p. 133, and May 1962,

Column Number

p. 321. Our 1945 estimate for N_M is 624 thousand. The estimates for YNT from 1945 to 1961 are as follows: 7, 9, 8, 8, 8, 8, 9, 9, 9, 10, 10, 11, 11, 11, 11, 11, 11, in thousands of workers.

The data prior to 1945 are special estimates prepared by the author. They had been built into the man-hours estimates of column 10 in this table. Alternative sources, which had not been built into man-hours are DBS Reference Paper No. 23 (Revised) *Canadian Labour Force Estimates*, and *National Accounts 1926-1956*, DBS (Revised) 1962, p. 100. These sources exclude YNT.

3 This is Column 2 less N_M. The sources are the same as for column 2. This series also includes estimates for YNT.

4 This series includes paid workers in both the private and government sectors, as well as employers, own account workers and unpaid family workers. The estimates in this series of the employed in YNT (N_{peY}) are the same as the estimates of the labour force, so that unemployment in YNT is not estimated.

7 Sources same as for column 2.

8 Same as for column 2. Note that col. 7 + col. 8 = col. 4.

9 Col. 10 ÷ col. 4, except for possible rounding error. Original source of col. 10 contained more digits than shown here.

10 This series are based on special estimates by the author. These are tied in with those for column 2. It is, however, known that the process used involved accumulating over twelve months of each year the products of employment and average hours of work, all adjusted to 365 or 366 days. Estimates of hours of work were aimed at hours actually worked, and sources ranged through "*The Labour Gazette*", and *Wage Rates and Hours of Labour in Canada*, published by the Department of Labour; *Man-hours and Hourly Earnings* of the Labour Division of DBS; and data on hours of work contained in *The Labour Force* current surveys and tabulations of the Special Surveys Division of DBS. Hours in the estimates already allowed for the effects of vacations, illness and strikes, but were subsequently adjusted to include also the effects of statutory and conventional holidays like Christmas, Civic Holiday, Labour Day and so on.

12 Wages, salaries and supplementary labour income of *National Accounts*, up to *National Accounts Income and Expenditure 1961*, DBS, Aug. 1962, Table 1, row 1 divided by man-hours of input by paid workers. The latter is formed by multiplying col. 7 and col. 9 of this table.

In symbols we have $w_h = \dfrac{w_p N_p + w_g N_g}{N_{pg} h}$.

Column Number

TABLE A–2

1 Table A–1, (col. 2 ÷ col. 1) × 100.

2 The labour force as a percentage of the civilian, non-institutional population 14 years of age and over (excluding YNT), as found in *Canada, Special Table* – 12-month averages Special Surveys Division, DBS, 9603-512, years 1950 to 1961. For 1946 to 1949 the data is found in *The Labour Force,* Reference Paper No. 58, 1958 Revision, Special Surveys Division, DBS. The data in the four quarterly surveys was averaged to obtain the estimated annual average.

4-11 Same sources as for col. 2.

Section B – Reproducible Wealth, and Miscellaneous

TABLE B–1

1 K_M^n is an estimate of the national stock of physical capital in the form of machinery and equipment. The stock includes both private sector and government holdings, but the latter excludes military hardware. The reason for this exclusion is that such defence goods do not act as a factor of production, assisting with the production of future GDP, as measured by the National Accounts.[1] The concept aimed at is the stock of machinery and equipment which does constitute a factor of production for future GDP, as measured.

This is an extremely complex concept to define let alone measure. Hence the estimates developed with the limited resources of this project can only be hoped to reveal a rough order of magnitude, with possibly appropriate movements.

The approach used is called the "perpetual inventory method". The inventory of capital is measured in units of constant dollars of value of the base year 1957. Value is thus in terms of prices paid, converted to the price level of machinery and equipment in the base period. Except under equilibrium conditions where the internal yield on capital is equal to the long-term interest rate plus an allowance for uncertainty, this value will tend to be less than the present value of all expected future marginal products of the capital, discounted to the present with the long-term interest rate plus an allowance for uncertainty. In fact it is this differential between market cost and internal

[1] This delineation involves some arbitrary elements. Military capital and manpower combine to produce a sense of security. This is valued in the national accounts at cost. But it does not assist with civilian production in the same way that a highway or school does.

Column
Number

value which we assume to provide a major inducement to investment. Inputs into the inventory are gross investments in machinery and equipment in the private sector, GI_M, and in the government sector, GI_{Mg}. Outflows from the inventory occur as a result of wear, destruction by fire and the elements and economic obsolescence. We subsume all of these under the blanket term "depreciation".

In order to carry our perpetual inventory forward we require a bench-mark stock of capital, the time series of inflows and a time series of estimated depreciation. The dynamic equation for the stock of capital is then

(1) $K_t = K_{t-1} + GI_t - D_t$. If gross investment and depreciation occur evenly throughout a calendar year, this stock can be assumed to be approximately dated as at June 30.

Our problem now is to get an estimate of a bench-mark stock, and a rate of depreciation on the current stock. To do this we begin by assuming an average life expectancy for new machinery and equipment. Taking into account rough engineering estimates, and the information found in *Output, Labour and Capital* by Professors Hood and Scott [39], an average life expectancy le = 16 years was used. With an assumed le, a bench-mark stock of capital becomes possible, using linear depreciation. Thus we assume that a piece of capital depreciates one sixteenth of its value in any one year, and hence at the end of its sixteenth year has no value left. Applying this concept, a formula for a bench-mark stock of machinery and equipment can be written down. For the moment we omit the subscript M.

$$(2)\ K_t = GI_t + \frac{le-1}{le} \cdot GI_{t-1} + \frac{le-2}{le} GI_{t-2} + \cdots + \frac{2}{le} GI_{t-le+2} + \frac{1}{le} GI_{t-le+1}$$

Our opening year of data on gross investment is 1926, and so our first possible bench-mark year t is given by t-16+1 = 1926, and hence t = 1941. For the year 1942 the same formula can be applied, using the GI data for 1927 to 1942. Alternately we may use the formulas,

$$(3)\ D_t = \frac{1}{le} \sum_{i=o}^{le-i} GI_{t-le+i}, \text{ and (1) above}$$

The resulting stock K_t can be assumed to be either an annual average stock, or the approximate value of the stock centred at mid-year or June 30.

Column Number

These formulas were applied to the estimates of $GI^n_M = GI_M$ (Table C–1, col. 5) + machinery and equipment portion of GI_g (Table C–1, col. 12). The latter proportion was obtained using *National Accounts* Table 54, government investment components, separately deflated by price indexes of plant and construction, and machinery and equipment. These components included some defence investment, and hence were only used to establish a ratio series. GI_g excluded any defence investment expenditure. With these data it was possible to obtain K^n_M 1941 to 1961.

It remained for us to estimate K^n_M from 1926 to 1940. This was done with the following formulas,

(4) $K_t = K_{t-1} - dK_{t-1} + GI_t$

(5) $K_{t-1} = \frac{K_t - GI_t}{(1-d)}$, where d is an average rate of depreciation on the standing stock of capital.

The rate of depreciation which produces D_t is $d^* = 1/16 = .0625$ applied to the gross stock of capital,

(6) $GK_{t-1} = \sum_{i=1}^{16} GI_{t-i}$. But the stock of standing capital K_t is net of depreciation, and on the average, and subject to the time profile of investment, will tend to be about one half depreciated. Hence to produce the same magnitude of depreciation D, the rate d must be about twice as large as the rate d^*.

Values of d were estimated from the data on K and GI, from 1942 to 1961. The results ranged from .0951 to .1169, with variation due to the changing time profile of GI_t. It now was necessary to decide what value of d to use to move the K series back to 1926. The technique of decision used was to try various values of d to establish what appeared to produce a reasonable range of series K_t 1926 to 1940. The average value of d from 1942 to 1961 (.1012) gave a K series 1942–1961 close to our estimates using formula (2) above. But in running the series back to 1926, we found the K value for 1926 seemingly too low in terms of reasonable trends in K^n_M /GDP, and in comparison with results for certain years obtained by Hood and Scott [39 p. 451]. We next tried $d = 2d^* = .1250$. This seemed to tilt the 1926 end of the K graph a little too high, and the 1961 end a little too low. Further testing and graphing led to the selection of $d = .1210$ to carry K^n_{Mt} back through 1940 to 1926. The results already obtained using formulas (1), (2) and (3) above were retained for the estimates from 1941 to 1961.

Column Number

2 K^n_{dPC} refers to the national stock of dwellings, plants or factories, and construction works such as roads, bridges, harbours, parks and land improvements. It includes the holdings of the private or business sector (which includes government operated business) plus the holdings of all levels of government, except for works which were constructed for defence purposes. Once again the perpetual inventory concept is used, to build up stock estimates from gross investment data in constant dollars of 1957. The national gross investment data is $GI^n_{dPC} = GI_{dPC}$ (Table C–1, cols. 3 + 4) + the portion of GI_g (C–1, col. 12 estimated to be dwellings, plant and construction.

The average life expectancy of this kind of capital is of the order of 50 years (cf. Hood and Scott [39] p. 473 ff.). Hence it was not possible to obtain a bench-mark stock using formula (2). Consequently it was necessary to obtain both a bench-mark estimate of this stock, and an appropriate rate of depreciation d on the net or depreciated stock.

The bench-mark selected was Hood and Scott's estimate for 1947 in 1949 dollars, as follows ([39] pp.444, 449, 450):

Net stock - total industry	\$9,106.1 m 49\$
Social Capital – government – construction (4,289.4 less estimate for defence)	4,266.8
Housing	9,342.2
Institutions	1,276.5
Total	\$23,991.6 m 49\$

Implicit price index, dwellings, plant and construction, for 1957 on 1949 base = 1.0000, is 1.4536. Hence $K^n_{dPC47} = 23{,}991.6 \times 1{,}4536 = 34{,}874$ m 1957 \$. (See also A. Scott [110], and O.J. Firestone [24] Table 100).

To obtain an appropriate rate of depreciation d we started off with $d = 2 \times d^{\cdot} = 2 \times \frac{1}{50} = .04$. This was of the same order of magnitude as the d implicit in the Hood and Scott data corresponding to the above, and for the series 1945 to 1955. This gave us a series for K^n_{dPC} which seemed on the basis of graphical analysis to be high in 1926, and to be low in comparison to the Hood and Scott estimates for 1953 onward. Consequently a slightly lower d = .039 was tried. This corrected the series at both the 1926 and 1955 ends, but it still seemed too high in 1926, relative to say its value in 1950, and too low in 1955 relative to Hood and Scott. The next trial was d = .0373, arrived at by an extrapolation with the previous results. The new series obtained from d = .0373, using the above bench-mark for 1947, and formulas (4) and (5) seemed to present a reasonable picture, and it was the one used in this study.

Column Number

4 Inventory stocks could be carried forward or backward using the *National Accounts* "Change in Inventories" (Δ H) in constant dollars, if one bench-mark stock value were known. The dynamic equation would be

(1) $H_t = H_{t-1} + \Delta H_t$, where H_t is dated at December 31 of year t, and ΔH_t refers to change in the stock from January 1 to December 31 of year t.

An estimate of Canadian inventory stocks is found in Scott [110] page 196. Scott gives estimates for 1947 and 1955, but believes his 1947 estimate to be more reliable. The estimates are in millions of 1949 dollars, and hence must be inflated to the price level of 1957 for our purposes. No published price indexes are very satisfactory for this purpose, especially since the mix of items in inventories may differ from the mix in sales, or that used in the weighting of published indexes. But the following expedient was used. Scott's estimates were separated into Livestock, and Other Business and Farm Inventories combined. The former was inflated by the wholesale price movement of Livestock, the latter by the movement of the General Index of Wholesale Prices, from 1949 to 1957. These price indexes were obtained from *Canadian Statistical Review*, Summary, 1959. The results were as follows:

Inventory Stocks	1947 m 49\$	Price Movement 1949 to 1957	1947 m 57\$
Livestock	1,570	.95015	1,492
Other Business and Farm Inventories	5,350	1.1467	6,135
Total Stock	6,920		7,627

The bench-mark figure of 7,627 was carried in both directions from 1947 using (1) above. The ΔH data used is found in Table C–1, col. 7.

For our purposes, a mid-year dating was more appropriate, since the K series were dated at mid-year. Mid-year values were estimated using the formula

(2) $H_{jt} = \frac{1}{2}(H_{t-1} + H_t)$.

6 If we assume that the Canadian economy does not suffer from structural unemployment because of surplus population in relation to resources, and that physical capital and manpower are in appropriate balance so that both are unemployed or at high level employment at the same time, then the rate of unemployment of labour can be used as an

Column Number

indicator of the rate of unemployment of capital. It seems appropriate to adjust capital for its degree of unemployment, in order for it to play its proper role in the production function. The adjustment was made only for fixed capital, and not for inventory stocks, using the formula

$$(1)\ K_p = H_j + K^n_{dPCM}\left[\frac{100.0 - (N^o_u - 2.0)\ \substack{+\text{ or}\\ \text{zero}}}{100}\right]$$

This formula embodies the assumption that fixed capital is fully utilized when the rate of unemployment of labour is 2.0 per cent or less. When this rate of unemployment becomes greater than 2.0 per cent, then the rate of utilization of capital is progressively reduced. For example, at unemployment of 3.0 per cent, the rate of utilization of fixed capital is computed by this formula to be 99 per cent.

7 F_2, which excludes interest and dividends received from abroad (π_{id}), is the export concept appropriate to Gross Domestic Product (GDP). It is derived from Table C–1, col. 8, less Table F–1, col 2.

8 F_1 is the import concept appropriate to GDP, and is derived from Table C–1, col. 9 (absolute value), less Table F–1, col. 1.

9 $GI^n_{dPCM} = GI + GI_d + GI_g = GI_{dPCM} + GI_g$ = Table C–1, col. 6 + col. 12.

10 Depreciation is assumed to occur only with respect to fixed capital. Since we have estimated total stocks of national fixed capital in dwellings, plant, construction, machinery and equipment, and since we have observed data on total gross investment in these areas, we are able to infer the volume of depreciation from the dynamic formula for the stocks. This formula is

$$(1)\ K^n_{dPCMt} = K^n_{dPCM,\ t-1} + GI^n_{dPCMt} - D^n_{rt}.$$

Everything in this formula is known, except D^n_{rt} . Thus col. 10(t) = col. 9(t) + col. 3(t–1) – col. 3(t). The first year for which we can obtain an estimate is 1927, for which we need the stock figures for both 1926 and 1927.

11 Indirect taxes less subsidies are obtained from the *National Accounts* publications of DBS, Table 1, in current dollars. In this column they are deflated to the purchasing power of 1957 dollars by the price index P. This price index is found in column 13 of this table.

12 The total income accruing to property and enterprise in the economy may be defined as non-wage income in Table 1 of the *National Accounts*, and includes rows 3 to 6: corporation profits before taxes, rent, interest and miscellaneous investment income; and accrued net income of farm and non-farm unincorporated business. This is designated as π_m in money terms or current dollars, and is not corrected by

Column Number

the inventory valuation adjustment. It is deflated to π in 1957 dollars by deflating undistrubuted corporation profits when positive by P_{dPCM} (the implicit price index in this study of GI_{dPCM}), and by then deflating the remainder by P as found in col. 13, of this table.

D_m is capital consumption allowances and miscellaneous valuation adjustments in current money terms as found in *National Accounts,* Table 1, row 10. It is deflated to D, its purchasing power in 1957 dollars, by P_{dPCM}.

13 This implicit price index corresponds roughly in concept to the price level of Net National Product (NNP). It is designed to provide a simple deflator for all income components in GNP that are not known specifically to be mainly destined for spending on GI_{dPCM}. The latter are assumed to be D_m (capital consumption allowances and similar business costs) and π^{+}_{cum} (undistributed corporation profits, when these are positive); and these are deflated by the implicit price index P_{dPCM} related to GI_{dPCM}. We then find P from the formula

(1) $P = \left(\dfrac{GNE_m - \pi^{+}_{cum} - D_m}{GNE - \pi^{+}_{cu} - D}\right) \times 100$, where the numerator is in market value or money terms, while the denominator is in constant 1957 dollars. The sources for formula (1) are as follows:

Numerator: National Accounts

Table 2, row 15 - Table 17, row 49(a) (when positive) - Table 1, row 10.

Denominator: Table C–1, col. 11 - Table F–1, col. 7 (when positive) - Table F–1, col. 11.

A more complex deflation of the income side could be carried out by tracing each income component to the areas of GNE where spent, and deflating each appropriate section of each component by the appropriate price index on the expenditure side. This would convert disposable income into their purchasing power, but would be a difficult deflation to achieve.

The values of P are shown to more digits than are significant, since extra digits were carried for computational purposes in the attempt to keep rounding errors away from the region of significant digits.

Column Number

Section C – Allocation of National Product to Final Uses

TABLE C–1

In this table we attempt to express all of the components of Gross National Expenditure (GNE) in the prices or price levels of 1957, or according to the purchasing power of dollars as they were in 1957. This involves of course a difficult and elusive theoretical concept, which will not be analysed here. There is a voluminous literature on this concept, but no attempt has been made to reference it here. However, for information on concepts and procedures used by the Dominion Bureau of Statistics to remove the effects of changing prices from the market value series of GNE, and thereby change this aggregate to a series of physical volume of output, the reader is referred to *National Accounts, Income and Expenditure 1926–1956*, DBS, Ottawa, 1962, p. 176.

The resulting series expressing the physical volume of GNE and its movements are found in the *National Accounts* publications, Table 5. Corresponding implicit price indexes are found in Table 6. These latter are based on the hypothesis or axiom that any aggregate market or money value time series can be factored into aggregate quantity and price components.

(1) $V_t = Q_t P_{ot}$, where o is the base period of price indexes. Then if we know V_t, and have estimated Q_t by the deflation of detailed components by appropriate price indexes, the price index of the aggregate is implied by (1), and is found from

(2) $V_t / Q_t = P_{ot}$.

When the data for this project were being assembled the sources available for a continuous series of deflated GNE were as follows: *National Accounts 1926–1956*, Ottawa, 1958; National Accounts, First Quarter, 1961; National Accounts, Fourth Quarter and Preliminary Annual, 1961; and subsequently *National Accounts, Income and Expenditure, 1961*. From these sources it was possible to obtain the deflation of GNE from 1926 to 1961 in constant 1949 dollars, and from 1947 to 1961 in 1957 dollars. It was desirable to have the data for this project in the dollars of the latest possible base period, 1957, so that the projections would be in values as close as possible to current price levels. Hence a major conversion operation was necessary, to obtain the whole series from 1926 to 1961 in 1957 dollars.

Column Number

Conversion of GNE and Components to Constant 1957 Dollars, 1926–1961

As technology and supply conditions change, and as consumer preference or utility functions or tastes change, the price pattern of the economy will alter. At the same time the pattern of quantities of goods consumed changes, and new goods come into market baskets while old goods are dropped out. For these reasons the quantity weighting patterns of price indexes are periodically changed, while at the same time the price pattern inherent in deflated GNE alters correspondingly. Three price patterns have now become involved in the deflation of GNE, as follows:

Time Period of Basic Deflation	*Time Period of Price Pattern Used*
1926–1947	1935–1939
1947–1956	1949
1956–1961	1957

Each of these sub-periods is deflated by price indexes with time bases (and approximately weight bases) as shown in the second column above, thereby producing a deflation approximately in terms of the constant prices of these periods. However when we want to chain these three sub-periods together to obtain a continuous deflated series in the prices of only one period, a major problem arises. Let us examine this problem.

Suppose we deflate GNE and components from 1956 to 1961 using 1957 based price indexes. We derive implicit price indexes for GNE and all major components. Now each of these indexes can be moved back to 1947 using the movements of the implicit price indexes derived from the 1949 based deflation. The components of GNE in money or market value terms from 1947 to 1956 can now be deflated by these implicit price indexes, to give GNE and components for these years in 1957 dollars. But we now find that unfortunately the minor components of a major component, will not add up to the major component, all in 1957 dollars; and at the same time the major components will not add up to GNE in 1957 dollars. In fact to obtain "equality" between any components and their total, an "adjusting entry" must be added into the National Accounts. These adjusting entries are found in Table 5 of the National Accounts whenever it is attempted to extend the use of a price base or pattern outside its own period of original deflation.

These adjusting entries present a problem when economic research is undertaken using the National Accounts data. For no economic meaning can as yet be ascribed to them. They represent numerical

Column Number

discrepancies which prevent any complete explanation of the allocation of production to final uses. They could be removed by allowing the detailed component deflation to add up exactly to new aggregates like total consumer expenditures and total GNE. But now the new implicit price indexes of these aggregates would have different movements than they had under their original and more basic deflation. Correspondingly the new aggregates of C and GNE would display different movements from those originally found in their basic deflation. This is accordingly not a suitable solution to the problem, especially where we are particularly concerned with both the quantity movements and allocation aspects of real GNE and components.

The adjusting entries are essentially expressing the situation that price patterns and allocation patterns become increasingly different from what prevailed in a base period, as we move farther and farther away from this period. Hence deflation to produce GNE valued in the individual prices of this base period becomes increasingly unrepresentative of the real world situation the farther we move away from the base period. The adjusting entries will consequently get larger.

Is there any way out of this impasse? For our project constant dollar allocations of output, and real movements of quantity series are of more importance than price levels and their movements. For ours is a study of development and growth in real terms. We could obtain both the appropriate level and movements of total GNE for the period 1947 to 1956 if we used the best deflation of GNE for this period (in 1949 dollars), but lifted the whole level of GNE so that it would meet the 1956 value of the 1957 dollar deflation. This involved lifting GNE in 1956, the overlap year, from 23,811 million 1949 dollars to its corresponding value of 31,508 million 1957 dollars. This involved a ratio of increase of 1.323,254. If now we applied this ratio to the whole series of GNE from 1947 to 1956, we could have lifted it to a level reflecting 1957 prices, while yet preserving its movements which would be more appropriately determined by its own deflation by 1949 based price indexes.

But this deflation by 1949 based prices also gives us the most relevant allocation pattern of GNE into its components, for the period surrounding 1949. We could preserve this allocation pattern by also raising all components of GNE in the 1949 deflation by the same ratio by which we raised GNE itself – that is by the constant GNE overlap ratio for 1956, $r_{056} = 1.323,254$. But while now we have GNE expressed in its best allocation pattern, with components also adding up exactly to their corresponding aggregates, without any adjusting entry, the question arises: have we lost the proper year to year movements of all

Column Number

of the minor and major components of GNE? The answer is: no, for the multiplication of all GNE_t and components by the constant ratio r_{056} leaves all real movements invariant for all components, as well as for GNE.

Here then we have a transformation of the 1947–1956 deflation, using 1949 prices, which lifts the results to a 1957 price level, but *without imposing the price pattern of 1957* on the deflated results. They retain the price pattern of 1949 as the basis of allocation, and year to year movements, which remain invariant under the transformation.

This is in effect the concept and procedure used in arriving at Table C–1. The price indexes implicit from this procedure will be somewhat different in level for the period 1947–1955, than those obtained by the DBS procedure. But their movements will be the same as for the DBS procedure, and as obtained in the original deflation of this period.

They will however experience a discontinuity of level and movement at the overlap years 1947 and 1956, and it is in fact this discontinuity which the DBS procedure avoids.

The same concept and procedure was used to link on the 1935–1939 deflation at the year of overlap, 1947. Now the overlap ratio was r_{047} = 2.252,231. One problem, mentioned above remained. There might be discontinuities in the detail of GNE, arrived at by two different methods, in the overlap year. This discontinuity would arise as a result of the abrupt shift from one price pattern to the other. This might cause volume movements in the components from 1946 to 1947 or 1955 to 1956 to be unrepresentative of the real situation. This was checked by graphing GNE and components and their implicit price indexes, and studying their movements around the years 1947 and 1956. No problem of discontinuity appeared around 1947. However at the 1956 link discontinuities did appear in most major components of GNE. Smoothing operations were accordingly undertaken for this link by graphical and arithmetic means, and in the light of study of the economic situation in the years involved. C was adjusted for 1954 and 1955 to provide a smoother transition. G, GI and GI_d were adjusted for the same years as C. F_2' and F_1' were adjusted for the years 1951 to 1955 inclusive.

Such then is the explanation for Table C–1, columns 1 to 11. The primary data for column 12 was derived with help from DBS in subtracting defence capital goods from total government spending on capital goods. The conversion of the whole series to 1957 dollars was carried out using the overlap ratios r_{056} and r_{047}, as above. Smoothing for 1954 and 1955 was carried out in the same proportions for C_g, GI_g and

Column Number

G_M as for total G. DBS is in no sense responsible for the result. Finally, we point out that where a multiplication of both components and totals including GNE by a constant factor occurs, the components may no longer add exactly to totals because of the rounding errors introduced.

TABLE C–2

In this table the objective was to separate the final use of total production (income) into consumption and investment, with government expenditure separated into these two categories for aggregation with private sector counterparts. With help from DBS, total government expenditure was separated into

(1) $G = C_g + GI_g + G_M$. This author of course takes full responsibility for the processing including smoothing, and hence the final results for these three component series. GI_g is discussed above, and equals government non-defence spending on capital goods. G_M represents all military or defence spending of government, including fixed capital purchased for defence purposes. G_M then represents social consumption for defence purposes. Capital goods are included in G_M since they do not contribute to the general civilian output of the economy in the same way that the capital goods of other government departments do. G_M is then treated as exogenous production and consumption. The assumption is that it is not motivated by the social and economic needs and opportunities of the time, but rather is influenced by international relations and developments. The G_M estimates appear in column 4 of this table. C_g represents all government non-defence and non-investment spending, and is thus the total current or social consumption of society. The estimates for C_g are set out separately in Table C–5, column 9.

1 Table C–1, col. 1 + Table C–5, col 9.

2 This is total investment in physical, reproducible capital, by the government and private sectors, excluding defence investment. Recall that $GI = GI_{PCM}$. Table C–1, cols. 6 + 7 + 12.

3 Table C–1, col. 8 - col. 9. This can also be defined as the Current Account Surplus, S_F.

4 Explained above under general description Table C–2.

6 Sum of cols. 1 to 5.

Column Number

7 to 10, & 12 Are columns 1, 2, 3, 5 and 4 divided by GNE, then multiplied by 100.

11 Gross National Saving, S in this study, is defined to be that portion of GNP which is not consumed for civilian and defence purposes. It is thus equal to col's. 6 – 1 – 4. This is also equal to the total Gross National Investment by residents in Gross Domestic Investment plus the trade balance plus residual error on expenditure side (cols. 2 + 3 + 5). $(S^n/GNE) \times 100 = S^{no}$, producing col. 11.

TABLE C–3

This table is derived by dividing all of the components of C–1 by total Canadian population N (A–1, col. 1) for the corresponding year.

TABLE C–4

Columns 1 to 6 are columns 1 to 6 of Table C–2, divided by population N.

8 (Table F–1, col. 1 - col. 2) divided by N.

9 This is total gross saving in the economy on a Gross Domestic Product (GDP) basis. GDP = value of all goods produced inside the geographical boundaries of Canada = GNP $+ \pi_{di} - \pi_{id}$. Hence Total Domestic Saving $= S^n + \pi_{di} - \pi_{id} = S^n + \pi^n_{di}$ col. 9 = cols. 7 + 8.

10 Table F–1, col. 3 divided by N. Also col. 10 = col. 6 - col. 8, other than for rounding error.

11 Table C–5, col. 9, divided by N for corresponding years

12 Table C–1, col. 12, divided by N.

TABLE C–5

This is a breakdown of total consumer expenditures in constant 1957 dollars into non-durable goods, durable goods and services. While the author obtained assistance on this breakdown from DBS, he takes full responsibility for the processing involved and for the final results. Electricity, gas and water used in households were all classified for this study as non-durable goods. The medical services in column 4 include in concept only that medical, hospital and nursing services paid for directly by the consumer by cash or through insurance. This series accordingly includes only a portion of the total health services

Column Number

provided in our society. For example it does not include health services provided by firms, institutions and government to employees, health services given to indigents, and the services provided by government hospitals and public health departments. The more comprehensive picture of the total health services will be found in the studies for this Royal Commission by Professors J.J. Madden and E.J. Hanson.[1]

9 The source and method for column 9 C_g has already been outlined in the discussion of G, GI_g, and G_M in Tables C–1 and C–2.

11 Total National Consumption C^n is equal to Total Private Consumption C (col. 8) plus Public Consumption C_g (col. 9).

TABLE C–6

1–8 Here we have expressed the components or private consumption shown in Table C–5, as percentages of their total.

9 Table C–5 (col. 9 ÷ col. 11) × 100.

Section D – Income Distribution to Factors of Production

TABLE D–1

1 *National Accounts 1926–1956*, DBS, Ottawa 1958; *National Accounts 1961*, DBS, Ottawa, 1962; Table 1 row 1 plus row 2.

2 As for col. 1. Rows 3 + 4 + 5 + 6.

3 As for col. 1. Row 7 with sign reversed. Row 7 = $IVA_m = -J_m$.

4 As for col. 1. Row 9.

5 As for col. 1. Row 10.

6 As for col. 1. Row 11.

8 In concept this series is made up of net national income at factor cost, plus capital gains on inventories (i.e., less IVA), plus government transfer payments (including interest on public debt), less corporation profits taxes, withholding taxes, government investment income and employer and employee contributions to social insurance and government pension funds. It rightly includes charitable contributions of corporations, and these have been left in Corporation Profits before Taxes in *National Accounts* Table 1. It includes undistributed corporation profits π_{cum} and adjustment on grain transactions (undistributed Wheat

[1] Hanson, E.J., *The Public Finance Aspects of Health Services in Canada*, Madden, J.J., *The Economics of Health*, studies prepared for the Royal Commission on Health Services, Ottawa: Queen's Printer (*in press*).

Column Number

Board and Canadian Co-Op. Wheat Producers profit) π^a_{um} . For this table we find Y_m from the equation $Y_m = Y_{pm} + \pi_{cum} + \pi^a_{um}$ = col. 12 + col. 11.

9 Col. 8 + col. 5.

10 This variable represents the amount of income which the three levels of government combined have to spend on the goods and services available in the economy. Referring to the *National Accounts* publications of col. 1, we find Y_{gm} in the following way: Table 9, row 18, less Table 10, row 21, less row 20(a), less row 20(b).

11 π_{cum} : *National Accounts* Table 17, row 49(a). π^a_{um} : Table 17, row 49(c).

12 *National Accounts* Table 3, row 7.

TABLE D–2

1–6 In these columns, the data in Table D–1, columns 8, 5, 9, 3, 10 and 6 are converted to percentages of GNP_m.

8 Table D–1, col. 10. Also this table col. 11 – col. 12.

9 *National Accounts 1926–1956*, DBS, Ottawa, 1958; *National Accounts 1961*, DBS, Ottawa, 1962; Table 2, row 2.

10 This table col. 8 - col. 9. Also *National Accounts* Table 10, row 22.

11 *National Accounts* Table 9, row 18.

12 *National Accounts* Table 10, rows 20(a) plus 20(b) plus 21.

Section E – Important Ratios Related to Growth and Some Important Growth Rates

TABLE E–1

1 This is the savings ratio appropriate to GDP. Table C–2, col. 2 ÷ Table F–1, col. 3.

2 Table F–1, col. 3 ÷ Table B–1, col. 5.

3 Col. 1 × col. 2.

4 Table F–1, col. 3. $\dot{}GDP_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$.

5 Table B–1, col. 1 ÷ Table F–1, col. 3.

6 Table B–1, col. 2 ÷ Table F–1, col. 3.

7 Table B–1, col. 3 ÷ Table F–1, col. 3.

8 Table B–1, col. 4 ÷ Table F–1, col. 3.

Column Number

9 Table B–1, col. 5 ÷ Table F–1, col. 3.

10 Table B–1, col. 5 ÷ Table A–1, col. 10.

11 Table F–1, col. 5 ÷ Table A–1, col. 10.

12 Table A–1, col. 12 ÷ Table B–1, col. 13.

TABLE E–2

1 Table C–2, (col. 1 ÷ col. 6) × 100.

2 Table C–2, (col. 4 ÷ col. 6) × 100.

3 (Table C–1, col. 1 ÷ Table F–1, col. 9) × 100.

4 $r = \left(\frac{\pi - J + \pi_{di} - \pi_{id}}{K}\right) \times 100.$

Numerator: B–1 col. 12 – F–1 col. 11 + F–1 col. 1 – F–1 col. 2.

Denominator: B–1 col. 5.

5 This is the ratio of the civilian wage bill deflated by P, to that part of civilian Gross Domestic Product to which an allocation to labour and capital seemed appropriate. The formula was

$$(1)\ y_L = \frac{W_{pg}}{GDP_c - T_{i-s} - (+\tfrac{1}{2}R_1)}$$

Numerator: (National Accounts, Table 1, row 1) ÷ Table B–1, col. 13) × 100.

Denominator: Table F–1, col. 5 – Table B–1, col. 11 – Table F–1, col. 13.

In any future refinement it may be better to include in the numerator an estimate of the wage component in the income of unincorporated business.

6 $y_K = 1 - y_L$.

7 Year to year growth rate formula applied to Table A–1, col. 10.

8 Growth rates for Table B–1, col. 6.

9 Col. 5 × col. 7 + col. 6 × col. 8.

10 Growth rates for Table F–1, col. 5.

11 Col. 10 – col. 9.

12 The formula for $\dot{A}$ is found in Chapter 8, as equation (10). To obtain column 12 we divide column 11 by (1 + column 9).

13 We give A a value 1.000 in 1926, and then carry it forward to 1927 by 1.000 $(1 + \dot{A}_{1927})$. Similarly $A_{1928} = A_{1927}(1 + \dot{A}_{1928})$, and so on.

Section F – Gross Domestic Product and Real Disposable Incomes

Column Number

TABLE F–1

1 *National Accounts*, Table 4, row 5, appropriately deflated. Implicit price index of main components of F_1' provided by DBS gave initial deflation. The series was then linked as for F_1' component ot Table C–1. The author takes full responsibility for the results.

2 *National Accounts*, Table 4, row 4, appropriately deflated. Implicit price index of main components of F_2' provided by DBS, gave initial deflation. The series was then linked as for F_2' component of Table C–1. The author takes full responsibility for the results.

3 This series depicts the total production of new goods within the geographical boundaries of Canada. Table C–1, col. 11 + Table F–1, col. 1 – Table F–1, col. 2.

4 The value added by the national defence sector of government is taken to be military pay and allowances. Assistance in the deflation of this component was provided by DBS. The results were then linked and smoothed in the same way as G in Table C–1. The author takes full responsibility for the results. An alternative approach would have been to deflate military pay and allowances W_{Mm} (*National Accounts*, Table 1, row 2) by the price index P (Table B–1, col. 13) to obtain W_M. This is in effect what is done when the income side of the accounts is deflated to obtain columns 6 and 9 of this table, for these contain military pay and allowances. W_M was in fact required for the econometric model in Chapters 9 and 10.

6 *National Accounts*, Table 3, row 7, deflated by Table B–1, col. 13.

7 *National Accounts*, Table 16, row 44(h), is deflated by the price index implicit in Appendix A and the National Accounts of GI_{dPCM} (P_{dPCM}), when these values are positive. Negative values are deflated by P, Table B–1, col. 13.

8 *National Accounts*, Table 17, row 49(c), deflated by P, Table B–1, col. 13.

10 Table D–1, col. 10, deflated bv Table B–1, col. 13.

11 *National Accounts*, Table 1, row 10, deflated by P_{dPCM} implicit in Appendix A and the National Accounts.

12 *National Accounts*, Table 1, row 7, deflated by Table B–1, col. 13.

13 *National Accounts*, Table 1, row 11, deflated by Table B–1, col. 13.

Appendix to Chapter 7 – Projection No. 1 (PR–1)

1 Population 1926–1961, from Table A–1, col. 1. Projected population 1966–1991 from the study by Dr. A. Stukel, (see Appendix E). The

Column Number	
	population projection in which net immigration was assumed to be 50,000 per annum was the one used for this study and the projections of economic growth.
2	For the years 1946 to 1949 these data were derived from DBS, Special Surveys Division, *The Labour Force*, Reference Paper No. 58, 1958 Revision. Four quarterly surveys were averaged to obtain annual averages. The purpose of these data was solely to obtain participation rates. From 1950 to 1961 the annual average data was obtained directly from DBS, Special Surveys Division, *Canada, Special Table*, 9603–512. These data were based on *The Labour Force* Survey definitions, and excluded inmates of institutions, Indians on reservations, the armed services and residents of the Yukon and the Northwest Territories (YNT). From 1966 to 1991 the estimates were prepared by applying labour force participation rates to population projected as given in Dr. A. Stukel's study (see Appendix E), with appropriate adjustments. Estimates for YNT were added in for these years, so that the labour force obtained in the projection corresponds to the civilian labour force N_I–N_M in the Basic Historical Data.
3	Same sources and explanation as for col. 2.
4,5	1946–1961, same as for col. 2. 1966–1991 projected on the basis of historical analysis, using graphical and arithmetic methods.
6	1946–1961, same as for col. 2. 1966–1991, col. 2 × col. 4.
7	Col. 3 × col. 5.
9	Table A–1, col. 9. 1966–1991 assumed for projection.
10	Table A–1, col. 5. 1966–1991, (col. 8 × col. 9) ÷ 100.
11	Table A–1, col. 4. 1966–1991, col. 8 – col. 10.
12	Table A–1, col. 9. 1966–1991, projected from 1961 value using compound annual growth rate of –.6712 per cent.
13	Col. 12 × 7/365, and × 7/366 for leap year.
14	Table A–1, col. 10. 1966–1991: (col. 11 × col. 12) ÷ 1,000.
15	Table E–1, col. 11. 1966–1991, projected from 1961 value using compound annual growth rate of 2.75 per cent.
16	Table F–1, col. 5. 1966–1991 col. 14 × col. 15.
17	Table F–1, col. 4 ÷ col. 5. 1966–1991 linear extrapolation based on graphical and other analysis.
18	Table F–1, col. 4. 1966–1991, col. 16 × col. 17.
19	Cols. (16 + 18).

Column Number	
20–23	Same procedure as for columns 17 and 18. The long-term trend in the ratio π_{di} / GDP_c has been downward, though it rose from 1945 to 1950, and from 1953 to 1961. It was assumed that as the economy continues to mature this ratio should continue its downward trend. In this projection the ratio was given a downward linear trend from its 1961 value to reach in 1991 the lowest level it had ever reached previously. This was its value in 1953. Within the context of a group of trading nations all growing at approximately the same rates (as a result of their interrelatedness) these ratios might eventually stabilize. The ratio π_{id} / GDP_c had had been fairly steady since 1946, and was projected with the constant value of .005.
24	Cols. (19 - 21 + 23).
27	Cols. 26 × 24.
28	Table C–6, col. 9. This ratio was on a steady climb since 1944. The graphical trend from 1947 to 1961, with slight modification downward, was projected linearly.
29	Cols. (27 × 28) ÷ 100.
30	Cols. (27 - 29).
32	Cols. (24 × 31) ÷ 100.
33	Cols. (24 - 27 - 32).
34	Table C–2, col. 11. 1966–1991: 100.0 - cols. (26 + 31).
35–37	Table C–6, cols. 1–3. 1966–1991, the graphical trends of these percentages were projected.
38–40	Table C–5, cols. 1–3. 1966–1991: (Col. 30 × cols. 35 - 37) ÷ 100.
41	Table C–4, col. 1. 1966–1991: Col. 27 ÷ Col. 1.
43	Table C–1, cols. (2 ÷ 11) × 100. 1966–1991: Trend of G° (graph) 1952–1961 projected linearly.
44	1966–1991: Cols. (24 × 43) ÷ 100.
45	Table C–1, col. 12. 1966–1991: Cols. (44–29–32).
46	Cols. (33 – 45).

Appendix to Chapter 8 – Projection No. 2 (PR–2)

In this extrapolation the civilian labour force is projected by detailed sex and age groups. The population source for the labour force – the civilian, non-institutional population aged 14 and over – was obtained from Dr. A. Stukel's study (see Appendix E). It was developed as a by-product of his population projection, and again the

Column Number

variant assuming net immigration of 50,000 per annum was used. As indicated in this appendix, separate population estimates were added in for YNT, thereby producing the data for population source N_{14i}, shown in PR–2.

The participation rates for each sex and age grouping were graphed for 1946 to 1961. The trends were studied intensively from the viewpoints of sociological, technological and economic developments. They were then projected on the same graphs, taking into account other projections, and trends in the United States participation rates. In this way the projected 100 pr_i data of PR–2 was obtained.

The civilian labour force data, $N_{1-M,i}$, was then derived by multiplying corresponding values of N_{14i} and pr_i.

31 Table A–1, col. 3. 1966–1991 data carried forward from cols. 5, 10, ---, 30.

33 Table A–1, col. 5; 1966–1991: Cols. (31 × 32) ÷ 100.

34 Cols. (31 - 33).

35 Table A–1, col. 10; 1966–1991: (PR–2, col. 34 × PR–1, col. 12) ÷ 1000.

36 $\frac{L_t - L_{t-5}}{L_{t-5}}$.

37 Compound annual growth rate of A from 1926 value to 1961 value was 1.7 per cent. This was the growth rate projected. In five years this growth rate produces an increase in A of 8.794 per cent.

38 Table E–2, col. 5; 1966–1991: projected on basis of graphical trend. This trend moderated after 1966.

39 The proportionate five-year change in GDP_c is calculated using formula (12) in Chapter 8.

40 Table F–1, col. 5. 1966 value = 1961 value × (1 + 1966 value, col. 39). Similarly for subsequent years.

41 In this projection the value added by national defence was brought closer into line with Dr. A. Stukel's assumptions on the numbers in the armed forces, in his preparation of the population source for the labour force estimates in this projection. Each five-year proportionate movement in Dr. Stukel's assumptions for N_M was increased by .01 to allow for the increased education and training needed in the armed forces. The resulting five-year growth rates were used to advance G_{M1} for 1961 (Table F–1, col. 4) through to 1991.

42 Cols. (40 + 41).

43–44 The same ratios projected for PR–1 were applied to GDP_c of PR–2 to project π_{di} and π_{id}.

Column Number	
45	Cols. (45-43 + 44).
47	The basic allocation formula for separating GNP into final uses is the same as that used in PR–1: $C^{no} = 75$; $G^{o}_{M} = 4$; $S^{no} = 21$; $GNE = 100$
48	1966–1991: (PR–1, col. 28 × PR–2, col. 47) ÷ 100.
49	Cols. (47-48).
50	See allocation pattern for col. 47.
51–52	See allocation pattern for col. 47.
53	1926–1961: Derived from Table C–5, col. 10, 1966–1991: Derived from PR–2, cols. (48 + 56).
54–56	This allocation of C was made using PR–1, cols. 35 - 37.
57	1966–1991: (Col. 47 ÷ PR–1, col. 1) × 1000.
59	1966–1991: (Col. 45 × PR–1, col. 43) ÷ 100.
60	Cols. (59 - 50 - 48).
61–63	Capital inflow was assumed to decrease from 1.0 per cent of GNE in 1966 to – 0.07 per cent in 1991 (Cf. text of Chapter 8). Taking into account this much addition to GNE for allocation to investment, trends in the ratios of GI_d, GI_{PC} and GI_M to GNE were projected. These ratios were augmented to allow for capital inflow and applied to column 45 to obtain columns 61 - 63.
64	The ratio H_j / GDP was projected graphically to have the following trend values beginning with 1961: .3675, .3550, .3490, .3430, .3370, .3310, .3250. Using these ratios H_j (June 30) was projected 1966–1991. ΔH_{jt+5} could then be computed as $H_{jt+5} - H_{jt}$. An average half year change from t to t+5 could be found by dividing ΔH_{j5} by 10. The half year changes ΔH_{jt} and ΔH_{jt+5} were added to estimate the annual change from Jan. 1 to Dec. 31 for year t, ΔH_t.
65	Columns (61 + 62 + 63 + 64).

Chapter 10 – Projection Number Three (PR–3F to PR–3C)

TABLE 1–F

The values of the variables in this table were all derived from the successive dynamic solutions of the econometric model of Chapter 9, except for F_2'. The latter variable is found in Table 3 in the

Column Number

Appendix to Chapter 10, as an exogenous variable. It is equal to F_2 (col. 6) + π_{id} (col. 10). It proved necessary to treat ΔH as exogenous in this solution, as explained in Chapter 10, and the resulting projected values of ΔH are found in Table 3, col. 12. In the main the variables tabulated in Table 1–F are endogenous.

TABLE 2–F

This table is derived from the values in Table 1–F, plus the values of G_M, ΔH and F_2' found in Table 3.

TABLE 1–C

The variables in this table are mainly endogenous. They are derived from the successive dynamic solutions of the econometric model. But, as explained in Chapter 10, the solutions were this time controlled by a government policy which attempted to steer the economy toward desired goals. At the same time certain structural corrections were made to the model where these seemed necessary. The structural corrections may be thought of as partially due to defects in the structure of the model, and partly also as a result of policy measures.

The policy operations and structural corrections are found in Table 4 of the Appendix to Chapter 10.

TABLE 2–C

This table is derived in the main from Table 1–C, but with G_M and ΔH drawn from Table 3, and with F_2' drawn from Table 3 (π_{id}) and Table 4 (F_2).

Appendix to Chapter 10

TABLE 3

1 The estimates for every five years were derived from Dr. A. Stukel's population projection, assuming net immigration of 50,000 (see Appendix E). This projection was approximately linear on a semi-logarithmic chart, and hence the annual interpolations in between the five year steps were done with compound annual growth rates.

3 The values for every five years, starting with 1961, were derived from the detailed projection, columns 1–30 of PR–2. The graph of these was

Column Number

approximately linear on a semi-logarithmic chart. The annual interpolations were accordingly done with compound annual growth rates.

4 Projected from 1961 value with compound annual growth rate of 1.7 per cent.

5 The values of G_M developed for PR–2 were used here for the five year steps beginning from 1961. Interpolation for annual values was done with compound annual growth rates, since G_M was carried along at 4 per cent of GNP in PR–2, and GNP had been developed by constant growth rate procedures.

6 Analysis of trends in foreign trade had led to a decision to project F_2 at a compound annual growth rate of 3 per cent, but to increase this rate by about a half a percentage point for each percentage point that the growth rate of GNP turned out to exceed 3 per cent. It was felt, after discussion of this point with Professor David W. Slater of Queen's University that such levels of exports would be necessary to sustain the higher growth rates of GNP on the one hand, and on the other hand that the higher growth rates of GNP would promote more production and effort in the export industries. In 1962 it was found that the level of exports advanced at 4.4 per cent in real terms (F_2). (F_2' in DBS, *National Accounts 1962,* Ottawa, 1963). Hence the 1962 observed value ($F_2'-\pi_{id}$) was used as an exogenous variable. The compound 3 per cent rate was then applied to this 1962 observed value of F_2.

7 The ratio $N_{enp} / N_{1\text{-}M}$ was graphed. It had a long-term downward trend reflecting the growth of larger scale production and the need to incorporate to arrange finance. This trend was continued, but moderated to reach what was felt to be a minimum value of .1000 in 1991.

8 The values projected in five year steps for PR–2 were used here. On the basis of graphical analysis, interpolation for annual values was done with compound annual growth rates.

9 W_M is military pay and allowances deflated by the price level P (Table 3–1, col. 13), and is hence based on a purchasing power concept. G_{M1} on the other hand was put directly on a constant price basis, for inclusion as a component of G on the expenditure side of the accounts. However for our projection it was felt that these two series should have roughly the same proportionate moments from year to year. Hence W_M was given its appropriate deflated value for 1961, and then was moved forward for the projection by the formula

(1) $W_{Mt} = \dfrac{W_{M61}}{G_{M161}} \times G_{M1t}$. W_M is essential for completing the income side of the accounts in constant dollars. An alternative and perhaps more fitting approach would be to use G_{M1} on both sides of the deflated

Column Number

national accounts, with a consequent revision of the price index P. But then all of the components of personal income would not have been deflated to a purchasing power concept.

10 The values used in PR–2, col. 44 were also used here. Interpolation to annual values was linear.

11 PR–2 values were used, with linear interpolation.

12 The 1962 value was used as recorded in *National Accounts 1962,* Ottawa, 1963. The five year values for 1966, 1971, etc. were taken directly from PR–2, col. 64. Annual interpolation was linear.

13 Annual mid-year inventory stocks were derived by the formula (1) $H_j = H_{j,-1} + \frac{1}{2}\ (\Delta H + (\Delta H)_{-1})$. Thus with H_{j61} as a bench-mark, H_j could be carried forward from it, with the help of col. 12.

14–15 Both A and F_2 were altered from their values used in the free projection, in an attempt to suit the conditions of the controlled projection. The changes made in them are depicted in Table 4, and the results are repeated here to give the complete sequence of values as revised for PR–3C.

TABLE 4

The reasons for the policy operations and structural corrections in the controlled projection, are discussed in the text in Chapter 10. We present here only an indication of the procedure used.

1 Government net revenue (disposable income) eventually became too strong, with the growth in GNP. Without a detailed picture of the tax system in the model, only the level of this function rather than its slope was adjusted. Adjustment of the slope would have been indicative of reducing tax rates. Our adjustment would suggest flat rate tax reduction or increase in transfer payments. The constant term m_o of the equation for Y_g was given a cumulative downward shift beginning in 1979. The cumulative shifts for 1981 and 1982 were $\Delta m_o = -1.000$ and -1.250, and the values used in the controlled solutions were $m_o + \Delta m_o$ ($-.927,618$ $-1.250 = -2.177,618$, for 1982, for example). (Perhaps some combination of change in level and slope would have been better, but this could only have been done in a meaningful way with a more detailed tax structure in the model). The differential shift from 1981 to 1982 was $\Delta(\Delta m_o) = -.250$. In each case an adjustment once made had to be maintained and added to, or the economy would have slipped back toward its earlier state.

2 Again the values are Δb_o, the cumulative shifts in government consumption (civilian). As mentioned above shifts had to be cumulative,

Column Number	
	for to abandon shifts already made would have let the economy slip back toward unsatisfactory conditions.
3	Cumulative encouragement to private consumption, again without specification of specific means.
4	This represents a cumulative discouragement of imports, without specifying the means. It could arise just from greater diversification and efficiency in Canadian secondary and service industries.
5	Exports were sometimes advanced at a pace faster than 3 per cent, to keep pace with the more rapidly growing economy in the projection operating under government guidance and democratic planning.
6	Shifts in the hours equation to offset its linear structure and to bring the results in line with the exponential decline of PR–1 and PR–2.
7	Beginning in 1970 technical progress was slowed down for a while to give the model time to catch up. Had advance experimentation been possible this need not have been done. The adjustment could have been made with faster increase in demand and perhaps a little more reduction in hours.
8	These were cumulative adjustments to slow down private investment demand which seemed to respond too well to sustained steady growth. The labour displacement effect of this investment seemed to become much greater then its stimulation of employment through demand. Consumer demand apparently would have had to advance much faster to absorb the supply effect of the new capital.

APPENDIX C

ECONOMETRIC METHODS USED IN ESTIMATING THE GROWTH MODEL OF CHAPTER 9

Purpose and Meaning of Econometrics

In Chapter 9 we attempted to specify the aggregative or macro behaviour of the total economic system, from a long-range growth point of view. Such specification is based on general economic theory, institutional studies, employment theory, and of course growth theory such as that outlined in Chapters 2 to 5 in this study. Our specification was in terms of relationships of direct cause and effect. Each endogenous variable in our total system was expressed as an effect, influenced by the most direct, proximate and immediate causes suggested by theory, and then subject to practical considerations of manageability, and availability of statistical observations. The causal influences might be other endogenous variables, lagged endogenous variables, exogenous variables, and finally a random impact or disturbance. This latter variable can be assumed to arise from a multitude of lesser causal variables which we are forced by economy to omit from our analysis, plus the effects of possibly unsystematic or purely random components in the behaviour of people and even in the physical universe, plus the effects of aggregation error.

To make these ideas more concrete, let Y_i be an endogenous variable which we are attempting to explain as an effect, let Y_{rj} and Y_{rk} be other endogenous variables which exert a direct causal influence on Y_i, and let Z_{ra} and Z_{rb} be predetermined variables (lagged and exogenous) which complete the catalogue of major variables which our theory leads us to believe influence Y_i directly. Then if we can arrange or transform our causal relationship so that it is approximately linear in form, we can express the final result as

(1) $Y_i = b_{ij}Y_{rj} + b_{ik}Y_{rk} + c_{ia}Z_{ra} + c_{ib}Z_{rb} + c_{io} + u_i.$

This could be for example a linear formulation of the consumption function expressed as equation(1), in the "Detailed Plan of Growth Model" of Chapter 9. The subscript r in this equation means that the particular Y or Z variables appear on the "right-hand side" of the equation. Those right-hand variables are also the causal variables.

The same endogenous variable Y_i will likely appear in other behaviour equations in the model as a direct causal variable. This produces a simultaneous interrelatedness among all of the equations of relation in the model.

Since an endogenous variable is one which is explained and determined within the economic system, it follows that there must be as many equations as there are endogenous variables in the system. Usually each equation is aimed at explaining one endogenous variable. (This rule does not hold however in the case of a market, where an equation of demand and an equation of supply jointly determine price and quantity, when the market is in equilibrium. There are two equations and two unknowns, but there is no equation to explain price. This is however a special case, where the more general case could be assumed to be a market in disequilibrium, but moving toward equilibrium. In this case we shall have three equations, one to explain each of demand, supply and price.)

To sum up the situation, we can say that for a complete model of the economic system we would have n equations in nY_i's$(i = 1, 2, \ldots, n)$, where usually each equation aims at a direct causal explanation of one of these variables. This can be thought of as the *ex ante* position. But as the equations and the endogenous variables interact, the economic system produces a simultaneous solution of the equations of the system, a macro general equilibrium. In this solution, each Y_i takes on the same value simultaneously in every equation, everywhere in the system where it appears. This becomes its solution value. These simultaneous solution values can be thought of as *ex post*. They reflect the fact that ultimately all endogenous variables are dependent variables, determined by the structure and by the independent variables, the Z's and the u's.

The purpose of econometrics is to measure the form and the parameters of the direct causal equations of the system, like (1) above. To do this it must begin by testing the extended hypotheses of the behaviour of different aspects of the economy. These are deduced forward from more primary or elemental axioms or hypotheses about unobservable micro-matters, until a breakthrough is made into observable micro and macro behaviour. This gradually establishes the form and specifications of each equation in the model. This is then followed by the estimation of all of the parameters in the system, like b_{ij} and c_{ia} in (1). In the linear case these parameters represent the direct marginal rates of influence of the causal variables on the endogenous variable being explained. They represent the basic, aggregative economic structure.

Out of this analysis we derive the meaning usually attached to econometrics: it is the measurement of economic structure, the measurement of economic relationships. But econometrics is really more than measurement, for it helps with specification of structure, and then it uses structure, once it has it measured, to assist with prediction, projection and policy formulation.

Approaches to the Estimation of Structure

The most complete procedures so far developed for estimating economic structure are the full information methods. These are known as "Full Information

Maximum Likelihood" and "Simultaneous Least Squares", and are explained in [96], [97], [99], [100]. These methods estimate the parameters of the whole model simultaneously, and are in harmony with the general equilibrium or simultaneous solution aspects of the economic system. They use all of the information in the form of the structure and identity relations of the system, and all of the observed data relevant to the system in one massive simultaneous operation.

These methods are, however, too difficult and costly to use as tools for the preliminary testing operations. Fortunately simpler and less costly methods have been formulated and because of the limited time and resources available for this study, these simpler methods were used for testing and estimating the structure of the growth model. In fact it would have been impossible to use the full information methods on this model anyhow, since it contained nonlinear terms like $N_e h$. Methods for systems which contain nonlinearities are now in the process of development.

The simpler procedures can be classed as single equation methods. Two of these methods were used in the estimation of the growth model. They are known as classical or ordinary Least Squares (LS), and Two-Stage Least Squares (TL).

Classical Least Squares (LS)

This is the method of linear regression and multiple correlation, by means of which a linear equation of relation is estimated. By the Markoff theorem on least squares (cf. [99]), these estimates are best, linear unbiassed, if the explanatory variables can be assumed to be fixed numbers, which could remain constant in repeated samples of the data. In (1) above, this could be assumed if all of the right-hand side variables are exogenous. But in the general case in an economic model this could not be assumed. Some of the explanatory variables will be endogenous, some lagged endogenous, some exogenous. What effect does this have on estimates of general economic relations, made with LS?

To explore this problem briefly let us use (1) in a simplified notation, and with two variables eliminated but still retaining the understanding that it is part of a larger system.

(2) $Y = bY_r + cZ_r + c_o + u.$

The LS estimates prove to be the same as the estimates obtained by using the right-hand side or causal variables as "instrumental variables" (cf. Klein [100] p. 123), to sweep out the random disturbance and obtain estimates of the b's and c's. To show the effect of this procedure we first eliminate the constant term by converting the data to deviations from mean values. Thus

(3) $y_t = Y_t - \frac{1}{T}\sum_{i=1}^{T} Y_t$. (There are T observations in our sample of data).

Then we multiply the reduced (2) by y_{rt} and add up over the sample of data, obtaining an equation of covariations or moments

(4) $m_{yyr} = b\, m_{yryr} + c\, m_{zryr} + m_{uyr}$, where

(5) $m_{zryr} = \sum^{T} Z_{rt}Y_{rt} - \frac{(\sum^{T} Z_{rt})(\sum^{T} Y_{rt})}{T} = \sum^{T} z_r y_r$.

Similarly, if we multiply reduced (2) by z_{rt}, and add up over the sample of data, we obtain

(6) $m_{yzr} = b\, m_{yrzr} + c\, m_{zrzr} + m_{uzr}$.

Equations (4) and (6) are the LS normal equations or estimation equations, provided we assume that the last term in each of them is zero. These last terms represent the covariations of the systematic causal variables with the random disturbance. It follows that, if these last terms are in fact not zero, we estimate b and c with error or bias. If Z_r is a truly exogenous variable, we could assume that nature could repeat the experiment over and over again with all Z_{rt} remaining fixed at their values in the first experiment, but with all Y_{it} in the system undergoing variation from sample to sample, as nature draws out different random samples of u_{it}. Under these conditions over repeated samples the expected value $E\, m_{uzr} = o$. Also, since random behaviour in the Y variables must be unrelated to variation in the Z_r variables (otherwise such behaviour would be systematic, not random) we have $m_{uzr} \rightarrow o$ as $T \rightarrow \infty$.

It follows that (6) will be a good estimation equation, whether for small or large samples. But we realize that for small samples we can except errors, since m_{uzr} may have large fluctuations about zero until the sample gets large enough to assume cancellation of almost all the pluses and minuses.

A further interesting possibility is that the error in (6) due to small samples will be larger (have larger dispension) the larger are the values (dispension) of u relative to Y. Then the higher is the coefficient of correlation R for (2), the lower will the small sample error (dispension) tend to be.

Next we must ask how (4) fares as an equation for estimating the structural parameters b and c. To use (4) we must assume $m_{uyr} = o$. In doing so we introduce a small sample error, just as in (6). But now we introduce another source of error. For Y_r is not an exogenous variable. It is an endogenous variable and hence is closely related to Y through other equations in the system. In fact, the observed values of Y_r are linear functions of all Z's and all u_i's in the complete system of equations. It follows that m_{uyr} contains the variation $\sum^{T} u_i^2$ $(i = 1, \ldots, n)$, and also all covariations $\sum u_i u_j$ $(j = 1, \ldots, n, \neq i)$. This variation and the accompanying covariations will neither have expected values, nor limits as $T \rightarrow \infty$, which approach zero. Thus m_{uyr} will not usually have an expected value of zero nor a limit which approaches zero as $T \rightarrow \infty$.

This is the source of least squares bias in the estimation of economic equations by LS. Like the small sample error, however, this bias will tend to be smaller, the smaller is the dispersion of u relative to Y, and hence the larger is R. For the smaller is u, the smaller will be m_{uyr}, the cause of the bias. (For a more detailed analysis of the LS bias in economic equations the reader is referred to Chapter 9 in [9 9] by Jean Bronfenbrenner, now Mrs. Crockett.)

Two-Stage Least Squares (TL)

This method was developed by Professor H. Theil [102]. It is a boon to econometrics because of its logic, its understandability, and its ease of computation. A limited test by the author [97] suggests that it produces results nearly as good (and possibly as good) as the "limited information maximum likelihood" method [99]. At the same time it is simpler to compute. Its explanation is as follows.

Suppose we substitute for Y_r in (2) a variable Y_r^* which is close to Y_r, but which is also a linear function of all of the exogenous variables (or predetermined variables) in the model. Such a variable would be completely uncorrelated with u in (2), except under some conditions when there are lagged Y's among the Z's. It would accordingly reduce this source of error in estimating b and c. But it might introduce another error to the extent that the difference between Y_r and Y_r^* affects the size of b.

The method of finding a Y_r^* in TL is to form the regression of y_r on all of the z's in the model.

(7) $y_r = p_1 z_1 + \ldots + p_k z_k + v$, where v is a random residual. Then remove v from y_r, leaving

(8) $y_r^* = p_1 z_1 + \ldots + p_k z_k$.

Equations (7) and (8) represent the first stage of two-stage least squares. The second stage is to estimate the parameters b and c in (2) by ordinary LS, but after substituting Y_r^* for Y_r.

A streamlined formula for computing TL estimates in terms of moment matrices M of the variables involved can be set up as follows. Let y_1 be the variable being explained. Let y_r be the vector of explanatory or causal endogenous variables, and z_r the vector of causal predetermined variables, all on the right-hand side of the equation. Let z be the vector of all predetermined variables in the system. Then the vector of parameters on the right-hand side of equation (2) is estimated by

$$(9)\ (b,c) = M_{y1z} M_{zz}^{-1} M_{zyr} M_{y1zr} \times \begin{bmatrix} M_{yrz} M_{zz}^{-1} M_{zyr}, & M_{yrz} M_{zz}^{-1} M_{zzr} \\ M_{zrz} M_{zz}^{-1} M_{zyr}, & M_{zrzr} \end{bmatrix}^{-1}$$

The resulting estimates of b and c by TL are *consistent*. This means that all bias is removed as the sample becomes infinite. Their considerable superiority over LS, even for small samples, is suggested by tests by the author recorded in [96] and [97].

Estimation Methods Used for the Growth Model of Chapter 9

It was possible to do a small amount of testing of alternative hypotheses — of exploratory probing and screening — for each equation. This was done by single

equation least squares, because of the ease and economy of using this method. The limitation of this method may be borne in mind for if the coefficients of correlation R are low, one might be rejecting good hypotheses by using this method. However, as can be observed in Chapter 9 the R values are all quite high, so that perhaps we were relatively safe on this count.

The single equation testing by LS was done by the International Business Machines Company Limited (IBM) on an electronic computer. At the time a variant of single equation LS known as Stepwise Least Squares (SWLS) had become popular, and because of its availability and economy this was the method selected for preliminary testing.

The basis of SWLS is that for each variable to be explained one uses a "shot gun" blast using every conceivable variable that might be relevant. The method then proceeds to pick out, step by step, one variable at a time, the seemingly best pattern of explanatory variables. At each step the process selects that variable which will reduce the unexplained variance of the Y variable being explained by the greatest proportion. The F distribution is used as the basis for this decision. The process terminates when either all variables have been tried, or when no further variable can be found which will reduce the variance unexplained by some specified proportion.

On examination, it appears that this is not the most appropriate LS programme to test the econometric model we have constructed despite its economy. In the first place it does not give the researcher adequate freedom of choice for testing alternative hypotheses regarding combinations of causal variables, once he has made his initial choice of what collection of variables to put into the "shot gun". The method then proceeds with a mechanical selection of a limited number of combinations of causal variables, which may not include certain combinations that the researcher might have selected had he been proceeding one hypothesis at a time. In fact the econometric researcher will want to be testing successive alternative *economic* hypotheses, each test based to some extent on what went before, and combinations which may seem important to him may not fall into the mechanical statistical steps selected by this programme.

A second shortcoming of SWLS from the point of view of econometric testing, is its limited selection of goodness of fit tests. The programme does provide the standard deviation of the portion of Y not explained by the equation (the "standard error of estimate" of the equation) and the "student t" values for the parameters associated with the explanatory variables. Other statistics of goodness of fit can be calculated by the researcher from the print-out of the programme, but this would be very time consuming for some of the statistics.

It is now felt that the best LS programme for the econometric researcher is one which tests only one economic hypothesis at a time, and which provides the full battery of statistical goodness of fit tests suggested below.

Despite these shortcomings seen in retrospect it is felt that SWLS did a fast and economical job of preliminary testing for us, and the experience gained, and the results themselves were valuable.

On the basis of this preliminary testing by SWLS the specification of causal variables to be contained in each equation in the model was decided upon. The next step was to estimate these equations in final form by one of the methods of simultaneous estimation, free of LS bias. The method selected was two-stage least squares (TL). Again the IBM Company did the calculations on an electronic computer. For a specified equation, the programme used this time produced estimates by single-equation least squares (LS), limited-information maximum likelihood (LI), and two-stage least squares (TL). The programme print-out included for each fitting the standard error of estimate of the equation, the unbiassed standard errors of the regression coefficients, the time series of the residuals u_t for each equation, and the value of δ^2/S^2 calculated from these residuals.

At the outset of the simultaneous estimation programme, the M_{zz} matrix for the model refused to invert, presumably because of too much multi-collinearity or parallelism of movement among some of the Z variables. The combinations of pairs of Z's with highest correlations were found, and one or more of the problem variables was then removed from M_{zz}, but used elsewhere as needed in the fitting. In one run of the estimates the variable t/10 was omitted, while in another run two variables t/10 and $p_{L,-1}$ were deleted. On top of this particular problem it next happened that a small number of the equations estimated by the LI–TL simultaneous estimation programme contained results which were not economically meaningful. Some error seemed to have got into the computations at these points, and there was not sufficient time or other resources available to experiment to find out what the difficulty was. For these equations it was necessary to use the original SWLS estimates, or sometimes the new LS results were used because they gave more significant digits. This latter circumstance arose in the case of the equation of demand for imports. In retrospect I feel that the problems that arose in the estimation of the model were mainly the result of too great a separation of the researcher from the computer (the simultaneous equations phase of the calculations (LS–LT–TL) was executed in New York). In a continuing operation, where researcher and computing staff are in daily contact, these problems would be dealt with as they arose.

Taking into account the fact that the computations were done at long range, and pretty much as a one trial operation, I now feel that we were fortunate indeed to have been able to come out of the operation reasonably successfully with a complete model.

In the layout of the final estimated model in Chapter 9 the column headed "Method of Estimation" tells whether the equation was selected from the SWLS, LS, LI or TL results. The final selection was based on criteria of economic rationality, followed by criteria of statistical goodness of fit.

The Battery of Statistical Tests of Goodness of Fit

In the display of the econometric growth model in Chapter 9, the following statistical tests have been, where available, set out accompanying each equation.

These are designed to help the researcher and the reader accompany their appraisal of the economic rationale of the equation, with a concomitant appraisal of the goodness with which the economic hypothesis has matched up with the quantitative observations of the economic variables.

1. *t-Statistic.* This statistic is formed by dividing an estimated parameter b by its unbiassed standard deviation from sampling $\bar{S}(b)$.[1] The t values are placed in brackets underneath the numerical estimates of the parameter to which they apply. The purpose of the t-statistic and its distribution is to test the hypothesis that the parameter is not significantly different from zero. It is consequently a statistical test of the economic hypothesis that the associated variable does exert a significant causal influence on the variable being explained by the equation.

   We find from tables of the t-distribution that for 30 degrees of freedom (number of observations less number of parameters in equation) we can reject the hypothesis that the parameter b is not significantly different from zero if (1) $t_b = b/\bar{S}(b)$, and if $|t_b| \geq 2.04$. In using this rule we take the risk of making a Type I error and rejecting a hypothesis when it is true, 5 per cent of the times we use it. (This means that we are using the rule at the .05 significance level).

2. *V: The Coefficient of Variation.* This statistic is calculated by the formula (2) $V = (S/Y) \times 100$. It is thus the standard error of estimate of the equation, as a percentage of the average value of the variable being explained. Consequently, V enables us to appraise the size (dispersion) of the random component of Y, relative to the average value of Y.

3. *R: The Coefficient of Correlation.* This statistic was calculated from the formula

   (3) $R = \sqrt{1 - \frac{\Sigma u^2}{\Sigma y^2}} = \sqrt{\frac{\Sigma y^2 - \Sigma u^2}{\Sigma y^2}} = \sqrt{\frac{\Sigma y_s^2}{\Sigma y^2}}$. It is consequently an estimate of the standard deviation of the systematic component of Y to the standard deviation of Y. Like V then it appraises, though in a different way, the relative proportions of systematic and random variation in Y. When there is more than one explanatory variable in the equation, R is called a coefficient of multiple correlation.

4. δ^2/S^2: *Von Neumann Ratio.* This is the ratio of the mean square successive difference to the variance [98]. It is calculated from the formula

   (4) $\frac{\delta^2}{S^2} = \frac{\sum_{t=2}^{T} (u_t - u_{t-1})^2}{\sum_{t=1}^{T} u_t^2} \times \frac{T}{T-1}$. This statistic tests for randomness in the

[1] $\bar{S}^2(b)$ is the appropriate diagonal element in $\bar{S}^2(u)$ times the inverse matrix appearing in (9). This formula is only asymptotically exact, as T gets larger and larger.

time sequence of u_t, that is for lack of serial correlation or autocorrelation. Our economic hypothesis is that the equation we are estimating with the data contains all of the causal variables which account for systematic variation in Y. Hence after these variables have exerted all of their systematic influence on Y_t, what is left over, u_t, should be purely random. Should u_t on the contrary display a systematic time pattern, rather than a random one, then our hypothesis that we have the true or best explanation of Y is rejected. It is the function of δ^2/S^2 to test the hypothesis that u_t has a random time pattern. For samples of size T = 31, the hypothesis of lack of *positive* serial correlation (which would be the case for trends or cycles in u_t) can be accepted at the .05 significance level if $\delta^2/S^2 \geq 1.48$. This is a one-tailed test. The hypothesis of lack of any autocorrelation, positive or negative, can be accepted at the .05 significance level, if δ^2/S^2 falls between the limits 1.36 and 2.78, for T = 30. This is a two-tailed test.

A further important aspect of this test is that the presence of serial correlation in the population of u_t introduces an error into the estimates of parameters and their t – values. This error can only be removed by using generalized least squares.

A Suggested Battery of Statistical Tests for Any Econometric Estimation Program for an Equation of Relation

This is presented as an opinion for those who prepare standard programs for electronic computers, and is based on the experience of one user of the results who has done a modest amount of econometric testing through the years. Firstly, the battery presented above has been found to be useful for appraising statistical goodness of fit, though each statistic, where relevant, should be corrected to its unbiassed form by adjustment for loss of degrees of freedom. Secondly, a time series graph of the residuals u_t is also a valuable accompaniment to the von Neumann ratio. From the graph we may not only be able to see any systematic time pattern which occurs, but we may then be able to use the pattern observed as an aid to discovering what major systematic cause has been left out of the analysis up to this point. Subject to the possible need to change our combination of explanatory variables, some such cause must be responsible for the systematic pattern of u_t.

Summary of Suggestions about Programme for Single Economic Equation of Relation

The first suggestion is that the program be designed to handle one equation at a time, with specifications as determined by the researcher. The second suggestion is that the programme arrange for a print-out of the estimates of the parameters, plus all of the goodness of fit statistics outlined above, including a

time graph of the residuals u_t. The detailed print-out of the numerical values of the u_t will then often be unnecessary, but could be retained as an optional part of the programme.

APPENDIX D

BIBLIOGRAPHY AND REFERENCES

I. Economic Development and Growth

1. ALLEN, R.D.G., *Mathematical Economics*, 2nd ed., London: Macmillan, 1959.

2. ANDERSON, W.H.L., and CORNWALL, J., "Problems of Growth Policy", *Review of Economics and Statistics*, vol. 43 (1961), p. 163.

3. ARA, K., "Capital Theory and Economic Growth", *Economic Journal*, vol. 68 (1958), p. 511.

4. ARNDT, H.W., "External Economies in Economic Growth", *Economic Record*, vol. 31 (1955).

5. ARROW, KALDOR, MIRRLEES, SAMUELSON, SOLOW, ROBINSON, MEADE, CHAMPERNOWNE, BLACK, STONE, BROWN. "Symposium on Production Functions and Economic Growth", *Review of Economic Studies*, vol. 29 (1961–2).

6. BALL, R.J., and SMOLENSKY, E., "The Structure of Multiplier-Accelerator Moders of the United States Economy, 1909–1951", *International Economic Review*, vol. 2 (1961), p. 294.

7. BAUMOL, W.J., *Economic Dynamics*, 2nd ed., New York: Macmillan, 1959.

8. BREMS, H., "Growth Rates of Output, Labour Force, Hours and Productivity", *Review of Economics and Statistics*, vol. 39 (1957).

9. CAVES, R.E., and HOLTON, R.H., *The Canadian Economy, Prospect and Retrospect*, Cambridge: Harvard Univ. Press, 1959.

10. CHAKRAVARTY, S., "The Existence of an Optimum Savings Program", *Econometrica*, vol. 30 (1962). p. 178.

11. ——————, "Optimal Savings With Finite Planning Horizon", *International Economic Review*, vol. 3 (1962), p. 338.

12. CHAMPERNOWNE, D.G., "Capital Accumulation and the Maintenance of Full Employment", *Economic Journal*, vol. 68 (1958), p. 211.

13. CLARK, C., *The Conditions of Economic Progress*, 2nd ed., London: Macmillan, 1951.

14. ——————, "Theory of Economic Growth", *Econometrica*, vol. 17 (1949, Supplement), p. 112.

15. DEHEM, R., "The Economics of Stunted Growth", *Canadian Journal of Economics and Political Science*, vol. 28 (1962), p. 502.

16. DENISON, E.F., *The Sources of Economic Growth in the United States and the Alternatives Before Us*, New York: Committee for Economic Development, Supplem. Paper No. 13, 1962.

17. DHRYMES, P.H., "A Multisectoral Model of Growth", *Quarterly Journal of Economics*, vol. 76 (1962), p. 264.

18. DOMAR, E.D., "Capital Expansion, Rate of Growth, and Employment", *Econometrica*, vol. 14 (1946), p. 137.

19. ________, *Essays in the Theory of Economic Growth*, New York: Oxford Univ. Press, 1957.

20. DUESENBERRY, J.S., "Business Cycles and Economic Growth", New York: McGraw-Hill, 1958.

21. EISENER, R., "On Growth Models and the Neo-Classical Resurgence", *Economic Journal*, vol. 68 (1958), p. 707.

22. FALLENBUCHL, Z.M., "Investment Policy for Economic Development: Some Lessons of the Communist Experience", *Canadian Journal of Economics and Political Science*, vol. 29 (1963), p. 26.

23. FERGUSON, C.E., "On Theories of Acceleration and Growth", *Quarterly Journal of Economics*, vol. 74 (1960), p. 79.

24. FIRESTONE, O.J., *Canada's Economic Development 1867 – 1953*, (Income and Wealth, Series VII), London: Bowes and Bowes, 1958.

24A. ________, Development of Canada's Economy, 1850–1900, *Trends in the American Economy in the Nineteenth Century*, National Bureau of Economic Research, Prince University Press, Princeton, 1960, pp. 217–252.

25. FRANKEL, M., "The Production Function in Allocation and Growth: A Synthesis", *American Economic Review*, vol. 52 (1962), p. 995.

26. FRISCH, R., "A Reconsideration of Domar's Theory of Economic Growth", *Econometrica*, vol. 29 (1961), p. 406.

27. GEHRELS, F., "Factor Substitution, Consumer Wealth, and Growth Stability", *American Economic Review*, vol. 47 (1957), p. 625.

28. ________, "Government Debt as a Generator of Economic Growth", *Review of Economics and Statistics*, vol. 39 (1957), p. 183.

29. GOODWIN, R.M., "The Optimal Growth Path for an Underdeveloped Economy", *Economic Journal*, vol. 71 (1961), p. 756.

30. HAAVELMO, T., *A Study in the Theory of Economic Evolution*, 2nd ed., Amsterdam: North-Holland Publishing Co., 1956.

31. HAMBURG, D., "Production Functions, Innovations and Economic Growth", *Journal of Political Economy*, vol. 67 (1959), p. 238.

32. HANSEN, A.H., *Economic Issues of the 1960's*, New York: McGraw–Hill, 1960.

33. HARROD, R.F., "An Essay in Dynamic Theory", *Economic Journal*, vol. 49 (1939), p. 14.

34. ________, *Toward a Dynamic Economics*, London: Macmillan, 1948.

35. ———, "Domar and Dynamic Economics", *Economic Journal*, vol. 69 (1959).

36. HICKS, J.R., *A Contribution to the Theory of the Trade Cycle*, Oxford: University Press, 1950.

37. ———, "A Value and Capital Growth Model", *Review of Economic Studies*, vol. 26 (1958–9), p. 159.

38. HOGAN, W.P., "Technical Progress and Production Functions", *Review of Economics and Statistics*, vol. 40 (1958), p. 407.

39. HOOD, Wm. C., and SCOTT, A., *Output, Labour and Capital in the Canadian Economy*, Ottawa: Royal Commission on Canada's Economic Prospects, 1957.

40. HORVAT, B., "The Optimum Rate of Investment", *Economic Journal*, vol. 68 (1958), p. 747.

41. JASZI, G., "The Measurement of Aggregate Economic Growth", *Review of Economics and Statistics*, vol. 43 (1961), p. 317.

42. JOHNSON, H.G., "Equilibrium Growth in an International Economy", *Canadian Journal of Economics and Political Science*, vol. 19 (1953), p. 478.

43. ———, "Economic Expansion and International Trade", *Manchester School*, vol. 23 (1955), p. 95.

44. ———, *Money, Trade and Economic Growth*, London: Allen and Unwin, 1962.

45. KALDOR, N., "A Model of Economic Growth", *Economic Journal*, vol. 67 (1957), p. 591.

46. KERVYN, A., "A Note on the Accelerator and Constant Growth", *Review of Economic Studies*, vol. 22 (1954–5), p. 61.

47. KEYFITZ, N., "The Interlocking of Social and Economic Factors in Asian Development", *Canadian Journal of Economics and Political Science*, vol. 25 (1959), p. 34.

48. KLEIN, L.R., and KOSOBUD, R.F., "Some Econometrics of Growth: Great Ratios of Economics", Quarterly Journal of Economics, vol. 75 (1961), p. 173.

49. KLEIN, L.R., "A Model of Japanese Economic Growth, 1878 – 1937", *Econometrica*, vol. 29 (1961).

50. KNORR, K. and BAUMOL, W.J. (eds.), *What Price Economic Growth*, Englewood Cliffs, N.J.: Prentice-Hall, 1961.

51. KURIHARA, K.K., *National Income and Economic Growth*, Chicago: Rand and McNally, 1961.

52. KURZ, M., "A Two-Sector Extension of Swan's Model of Economic Growth: The Case of No Technical Change", *International Economic Review*, vol. 4 (1963), p. 68.

53. LANGE, O., "The Rate of Interest and the Optimum Propensity to Consume", *Economica*, vol. 5 N.S. (1938), p. 12.

54. LEWIS, W.A., *The Theory of Economic Growth*, London: Allen and Unwin, 1955.

55. LUNDBERG, E., *Studies in the Theory of Economic Expansion*, London P.S. King, 1937.

56. MEADE, J.E., *A Neo-Classical Theory of Economic Growth*, London: Allen and Unwin, 1961. (Review by BORTS, G.H., *Economica*, vol. 29 (1962), p. 72).

57. NATIONAL BUREAU OF ECONOMIC RESEARCH, *Long-Range Economic Projection*, (Studies in Income and Wealth, vol. 16) Princeton: Univ. Press, 1954.

58. ________________, *Output, Input and Productivity Measurement*, (Studies in Income and Wealth, vol. 25), Princeton: Univ. Press, 1961.

59. OKUN, B. and RICHARDSON, R.W. (eds.), *Studies in Economic Development*, New York: Holt, Rinehart, and Winston, 1961.

60. PASINETTI, L.G., "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth", *Review of Economic Studies*, vol. 29 (1961–2), p. 267.

61. PEARCE, I.F., "The End of the Golden Age in Solovia: A Further Fable for Growthmen Hoping to be 'One Up' on Oiko", *American Economic Review*, vol. 52 (1962), p. 1088.

62. PHELPS, E., "The Golden Age of Accumulation: A Fable for Growthmen", *American Economic Review*, vol. 51 (1961), p. 638.

63. PHILIPS, A.W., "A Simple Model of Employment, Money and Prices in a Growing Economy", *Economica*, vol. 28 (1961), p. 360.

64. PITCHFORD, J.D., "Growth and the Elasticity of Factor Substitution", *Economic Record*, vol. 36 (1960), p. 491.

65. POWER, J.H., "The Economic Framework of a Theory of Growth", *Economic Journal*, vol. 68 (1958), p. 34.

66. RAMSEY, F.P., "A Mathematical Theory of Saving", *Economic Journal*, vol. 38 (1928), p. 543.

67. RANIS, G., and FEI, J.C.H., "A Theory of Economic Development", *American Economic Review*, vol. 51 (1961), p. 533.

68. ROBINSON, J., "Accumulation and the Production Function", *Economic Journal*, vol. 69 (1959), p. 433.

69. __________, "Equilibrium Growth Models", *American Economic Review*, vol. 51, (1961), p. 360.

70. __________, *Essays in the Theory of Economic Growth*, London: Macmillan, 1962.

71. ROSE, H., "The Possibility of Warranted Growth", *Economic Journal*, vol. 69 (1959), p. 313.

72. ROSTOW, W.W., *The Stages of Economic Growth*, Cambridge, Mass.: Univ. Press, 1960.

73. SALTER, W.E.G., *Productivity and Technical Change*, Cambridge: Univ. Press, 1960.

74. SCHUMPETER, J., *Business Cycles*, 2 vols., New York: McGraw-Hill, 1939.

75. SMITH, D.C., "Monetary-Fiscal Policy and Economic Growth in an Open Economy", *Quarterly Journal of Economics*, vol. 74 (1960), p. 614.

75A. __________, "Corporate Saving Behaviour", *The Canadian Journal of Economics and Political Science*, vol. 29 (1963), p. 297.

76. SMITHIES, A., "Economic Fluctuations and Growth", *Econometrica*, vol. 25 (1957), p. 1.

77. __________, "Productivity, Real Wages and Economic Growth", *Quarterly Journal of Economics*, vol. 74 (1960), p. 189.

78. SOLOW, R.M., "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, vol. 70 (1956).

79. ________, "Technical Change and the Aggregate Production Function", *Review of Economics and Statistics*, vol. 39 (1957), p. 312.

80. ________, "Technical Progress, Capital Formation, and Economic Growth", *American Economic Review*, vol. 52 (1962), p. 76.

81. SWAN, T.W., "Economic Growth and Capital Accumulation", *Economic Record*, vol. 32 (1956).

82. TINBERGEN, J. and BOS, H.C., *Mathematical Models of Economic Growth*, New York: McGraw-Hill, 1962.

83. TOBIN, J., "A Dynamic Aggregative Model", *Journal of Political Economy*, vol. 63 (1955), p. 103.

84. URQUHART, M.C., "Capital Accumulation, Technological Change, and Economic Growth", *Canadian Journal of Economics and Political Science*, vol. 25 (1959).

85. URQUHART, M.C. (ed.), *Historical Statistics for Canada* (for the Canadian Political Science Association), Toronto: Macmillan, about 1963.

86. VALAVANIS-VAIL, S., "An Econometric Model of Growth: Proceedings, vol. 45 (1955), p. 208.

87. YOUNG, A.A., "Increasing Returns and Economic Progress", *Economic Journal*, vol. 38 (1928), p. 527.

88. ZIMMERMANN, E.W., *World Resources and Industries*, New York: Harper, 1933.

II. Employment Theory and Econometric Models

89. BROWN, T.M., "Habit Persistence and Lags in Consumer Behaviour", *Econometrica*, vol. 20 (1952), p. 355.

90. ________, "Some Recent Econometric Developments", *Canadian Journal of Economics and Political Science*, vol. 25 (1959), p. 23.

91. ________, "A Forecast Determination of National Product, Employment and Price Level in Canada from an Econometric Model", *Models of Income Determination* (Conference on Research in Income and Wealth, vol. 28), NBER, Princeton: Univ. Press, 1964.

92. KEYNES, J.M., *The General Theory of Employment, Interest and Money*, London: Macmillan, 1936.

93. KLEIN, L.R., *The Keynesian Revolution*, New York: Macmillan, 1947.

94. ________, *Economic Fluctuations in the United States 1921 – 1941*, (Cowles Commission Monograph No. 11), New York: Wiley, 1950.

95. ________, and GOLDBERGER, A.S., *An Econometric Model of the United States 1929–1952*, Amsterdam: North-Holland Publ. Co., 1955.

III. Econometric Methods

96. BROWN, T.M., "Simplified Full Maximum Likelihood and Comparative Structural Estimates", *Econometrica*, vol. 27 (1959), p. 638.

97. ________, "Simultaneous Least Squares: A Distribution Free Method of Equation System Structure Estimation", *International Economic Review*, vol. 1 (1960), p. 173.

98. HART, B.I., and VON NEUMAN, J., "Tabulation of the Probabilities for the Ratio of the Mean Square Successive Difference to the Variance", *Annals of Mathematical Statistics*, vol. 13 (1942), p. 207.

99. HOOD, Wm. C., and KOOPMANS, T.C., (eds.), *Studies in Econometric Method*, (Cowles Commission Monograph No. 14), New York: Wiley, 1953.

100. KLEIN, L.R., *A Textbook of Econometrics*, Evanston, Ill.: Peterson & Co., 1953.

101. RALSTON, A., and WILF, H.S., eds., *Mathematical Methods for Digital Computers*, New York: Wiley, 1960.

102. THEIL, H., *Economic Forecasts and Policy*, 2nd ed., Amsterdam: North-Holland Publ. Co., 1958.

IV. General

103. ARISTOTLE, *Politics (Transl.)*, New York: Modern Library, 1943.

104. BREWIS, T.N., ENGLISH, H.E., SCOTT, A., JEWETT, P., *Canadian Economic Policy*, Toronto: Macmillan, 1961.

105. BUCHANAN, J.M., and STUBBLEBINE, Wm. C., "Externality", *Economica*, vol. 29 (1962), p. 371.

106. GALBRAITH, *The Affluent Society*, New York: Houghton Mifflin, 1958.

107. JOHNSON, H.G., "The Social Policy of An Opulent Society", Speech, (Mimeo), Canadian Welfare Council, Ottawa, May, 1961.

108. KRAVIS, I.B., "Relative Income Shares in Fact and Theory", *American Economic Review*, Dec. 1959; vol. XLIV.

109. ROBBINS, L., *An Essay on the Nature and Significance of Economic Science*, London: Macmillan, 1932. (Espec. p. 54 re meaning of economic statistics and the need to revalue physical quantities as prices change).

110. SCOTT, A., "Canada's Reproducible Wealth", Chap. 8 in *The Measurement of National Wealth*, (Income and Wealth Series VIII), International Assoc. for Res. in Inc. & Wealth, London: Bowes and Bowes, 1959.

111. TAYLOR, M.G., "Government Planning: The Federal-Provincial Health Survey Reports", *Canadian Journal of Economics and Political Science*, vol. 19 (1953), p. 501.

112. WOOD, W.D., "Manpower and Employment", Evidence to The Senate of Canada, March 1, 1961, Ottawa: Queen's Printer, 1961.

V. Special Canadian Problems

113. BANK OF CANADA, *Press Releases, Relating to J.E. COYNE, Ottawa, 1959–61.*

114. DEUTSCH, J.J., KIERSTEAD, B. S., LEVITT K., and WILL, R. M. (eds), *The Canadian Economy:* Selected Readings, Toronto: Macmillan, 1961.

115. GORDON, W. L., *Troubled Canada*, Toronto: McLelland and Stewart, 1961.

116. JOHNSON, H. G., *The Canadian Quandry*, McGraw-Hill, Toronto, 1963.

117. ROYAL COMMISSION ON CANADA'S ECONOMIC PROSPECTS, *Final Report*, Queen's Printer, Ottawa, 1957.

118. SENATE OF CANADA, *Special Committee on Manpower and Employment*, Final Report and Proceedings, Numbers 1 to 25, Submissions particularly by DENTON, F.T., DEUTSCH, J.J., HOOD, Wm. C., and WOOD, W.D.

APPENDIX E

POPULATION PROJECTIONS, CANADA, 1961—1991

Dr. A Stukel[1]

The Royal Commission on Health Services required population projections for Canada for the period 1961 to 1991 in order (1) to assess the extent of health services required by Canada's growing population, (2) to determine the professional and other manpower, capital facilities and institutional arrangements necessarv for an expanding and changing health services programme, and (3) to prepare estimates of the nation's future income in order to establish Canada's growing ability to pay for the increased health services required by the Canadian people, the latter expressed in terms of health expenditure as a proportion of Gross National Product, the sum total of all goods and services produced in Canada in a given year.

To meet these requirements the population projections presented in this Appendix have been prepared covering the period 1961 to 1991 at quinquennial intervals. Separate estimates of population are given providing breakdown by sex, age and educational standards. Further projections are presented of mortality rates, and fertility rates of women for the period up to 1991. The projections of total population are presented on the basis of five different alternatives allowing for the following variations of net immigration: zero, 10,000, 25,000, 50,000 and 100,000. The population projections used by the Royal Commission on Health Services is based on the assumption of net immigration of 50,000.[2] The population projections

[1] Dr. A. Stukel is a Senior Statistician with Central Mortgage and Housing Corporation and lectures in Advanced Statistics at the University of Ottawa. The author is indebted to: Dr. G.B. Oakland, Mr. A.H. LeNeveu, Mr. H.G. Page, Miss M.E. Fleming and Miss Y. Kasahara of the Dominion Bureau of Statistics for their comments and assistance on the mortality and the fertility projection. Miss Kasahara was particularly helpful in discussing some methodological points of the projection. Miss V. Cross and Miss I. Kilroy of the Dominion Bureau of Statistics handled very capably the computational work.

[2] The Royal Commission on Canada's Economic Prospects assumed net immigration to average 75,000 per annum. This assumption was based largely on the high levels of net immigration experienced in the first post-war decade. Since 1957 net immigration has declined. For this reason the Royal Commission on Health Services has used a lower rate of net immigration, 50,000 per annum (Royal Commission on Canada's Economic Prospects, *Final Report,* Queen's Printer, Ottawa, 1957, p. 103.).

are shown in Tables 1 to 14 at the end of this Appendix. The methods used and the basic assumptions underlying the projections are described below.

The population projections referred to in this study for the Royal Commission on Health Services differ somewhat from those prepared for the Royal Commission on Canada's Economic Prospects, published in 1957,[1] mainly for two reasons: (1) availability of more recent and comprehensive data including the results of the 1961 Census; and (2) some variation in methods used in preparing the population projections described in greater detail below.

Notwithstanding the differences in methods and the more complete data available in preparing the population projections presented here, the two sets of estimates reflect rather similar long-term trends and growth rates. Table 15 at the end of this Appendix presents summary data of population projections both male and female, on the assumption of annual net immigration of 50,000 for the period 1960 to 1980[2] covering the population projections prepared for the Royal Commission on Canada's Economic Prospects and for the period 1961 to 1981 prepared for the Royal Commission on Health Services.

The first estimate suggests a population increase for the period 1960 to 1980 of 48.4 per cent as compared with an increase of 54.9 in the second estimate. The comparable annual average rate of increase is 2 per cent and 2.2 per cent respectively covering the two decades for which comparable data are available.

Partly because of this 0.2 per cent differential in annual growth rates (compound) and partly because Canada's population had reached a greater number in 1961 than had been anticipated in the population projection prepared for the Royal Commission on Canada's Economic Prospects, Canada's population, as presented in this study, may be greater by over two million in 1980.[3]

In considering the population projections presented in this study their approximate character should be borne in mind. Essentially the accuracy of a population projection depends to a large extent on the reliability and rationale of the underlying assumptions that have been made in preparing the estimates. The assumptions made in this study appear to be realistic in the light of present knowledge and data available and the resulting population projections may be considered to be conservative estimates. Still it would be highly desirable to review the underlying assumptions periodically and if changes are indicated, to make the appropriate revisions in the population projections presented here.

Assumptions

In making the population projections presented in this Appendix, three variables were used: mortality rate, fertility rate and net immigration. Implied in the

[1] Hood, Wm.C.,and Scott, A., *Output, Labour and Capital in the Canadian Economy*, a study prepared for the Royal Commission on Canada's Economic Prospects, Ottawa, 1957, Chapter 4, pp. 155 to 181.

[2] The population projections for the Royal Commission on Canada's Economic Prospects extend to 1980 while the estimates presented here cover the period up to 1991.

[3] This difference is reduced to over one million if the comparison is made on the basis of net immigration of 75,000 per annum as used by the Royal Commission on Canada's Economic Prospects and of 50,000 per annum as used by the Royal Commission on Health Services.

population projections is the assumption of a certain stability in human behaviour as evidenced by past trends. Modifications were introduced where this appeared appropriate in the light of changes in the population pattern and experiences in countries with similar demographic trends such as the United Kingdom, United States (see particularly section on mortality rates discussed below). Other assumptions basic to the population projections presented here include: no global war, other major disasters or serious depression.

Mortality Rates

Mortality rates have exhibited, in general, a continuous decline for all age groups and both sexes since the beginning of vital statistics system in Canada. The decline has been especially pronounced for younger ages. The rates for ages up to the age of 30 have shown significant convergence. This has been particularly true for the first five ages of life. This convergence of rates accompanied by a gradual levelling off of the decline can be explained to some extent by the fact that the main causes of death in recent years are various accidents which cannot be expected to decrease substantially in our technological era.

When projecting the mortality rates of the last four decades, the following factors were taken into account:

1. the past rate of change
2. the main causes of death in each age group
3. the level of mortality rates and their behaviour for each age group in the countries which are known to enjoy lower rates compared to Canadian experience (Sweden, New Zealand). Account was also taken of the United Kingdom and United States experiences and trends. Table 4 gives the mortality rates used.

Fertility Rates

Projections of fertility rates are a difficult undertaking. There is no other demographic factor which shows more unpredictable changes. This is particularly true for the two main child-bearing age groups: 20–24 and 25–29.

After explaining the increase in the fertility rates in the late forties as a compensation for and postponement from the depression years, the demographers were at a loss to account for continuous increase in the rates in the early fifties.

A gradual decline has been noticeable during the last four decades in fertility rates for female ages of 35 and over. This means that the size of the family is consolidated earlier than it used to be. A persistent decline of the average age at marriage, probably also contributed to such a concentration of births in the younger female age groups. Moreover, the fertility rate of females in the age group 30–34 has also been declining during the last six years.

The three age groups which showed a continuous increase in fertility rates: 15–19, 20–24 and 25–30, have exhibited a decline in their rate of growth during the recent years. It seems that they have just reached their peak.

The projections for the future, therefore, follow, in a conservative manner the trends and changes noticed during the last decade. The concentration of births in the younger age groups coupled with the lower age at marriage is the reason for allowing a slight increase for only one age group: 15–19.

Table 5 gives the fertility rates used in the projections.

Immigration

In all post-war years up to 1957, there were more male than female immigrants entering Canada. It is also interesting to note that in those years there were more males of all ages up to age 50. Since 1957, however, female immigrants are predominant in all ages over 14. It seems that the immigrants of earlier years have been bringing the members of their families to Canada to greater extent than before. Any change in government policy which increases immigration will probably reverse the pattern of the recent years to approximate the earlier period.

For projection purposes, the age distribution of immigrants has been assumed to be the average of the years 1950–1961, which takes the following pattern (assuming 100,000 immigrants a year):

Age Group	Male	Female	Total
0 – 4	4,533	4,277	8,810
5 – 9	4,174	3,946	8,120
10 – 14	2,858	2,691	5,549
15 – 19	4,065	3,776	7,841
20 – 24	10,209	9,381	19,590
25 – 29	9,069	8,205	17,274
30 – 34	6,132	5,428	11,560
35 – 39	3,746	3,360	7,106
40 – 44	2,175	2,011	4,186
45 – 49	1,587	1,592	3,179
50 – 54	965	1,300	2,265
55 – 59	637	987	1,624
60 – 64	443	750	1,193
65 – 69	310	556	866
70 – 74	201	371	572
75 +	90	175	265
Total	51,194	48,806	100,000

Since the age distribution of emigrants is not available, it was assumed to be the same as that of the population already in Canada in any given future quinquennium.

Age and sex distribution of net immigrants was taken to be proportionately the same for all levels of net immigration. Mortality and fertility data of immigrants were assumed to be the same as those of the native Canadian population.

Notation and Methodology Used in the Population Projection

Notation

^tP_i = population of age i at time t

M = male population

F = female population

^tP = $^tM + {}^tF$

^tB = born during the year t

^tI_i = net migration population of age i entering country during the year t

^td_i = age (i) specific death rate at time t

^tf_i = age specific fertility rate

i refers to the age group rather than the single years of age except where the contrary is self-evident.

Methodology

The purpose of the projection was to provide under various net immigration assumptions an estimate of population in Canada by five-year age groups and by sex at the end of five-year intervals: 1966, 1971, 1976, 1981, 1986 and 1991.

The following notes on the methodology used retain the actual stages in the projection work.

1. *Survivors of the Existing Population*

(i.e. I = O and B = O). The first and also natural task of the projection was to arrive at the number of survivors of the present (1961 Census) Canadian population at the end of each quinquennium.

Since the age specific death rates, both past and projected, change very slowly within the same age group and with time, the following formula was used to estimate survivors of the age group ^tP_i at the beginning of the next quinquennium.

$$^{t+5}P_{i+5} = {}^tP_i\,(1 - {}^{t+2\frac{1}{2}}d_i)^5$$

Note that the age specific mortality rate was taken at the middle of the quinquennium.

2. *Survivorship of the 0 – 4 Age Group*

The formula under (1) could not be used for computing the survivorship of the population between ages 0 and 4 because in the past within this group the mortality

rates changed significantly from one age to the next, even though in recent years they did exhibit a remarkable convergence. The death rates of this age group have declined more rapidly than in any other age group. For these reasons, the survivorship of this group was computed for every age in the group. An additional complication arose from the fact that the census age data are given as of the last birthday. For example, those reported of age 2 are really all those who just completed their second birthday up to those who reached their 3rd birthday on the census date. For this reason, somewhat more elaborate formulae were used to compute the survivors of this particular group. The following is an example of the scheme used using the computation of the June 1966 survivors of age 5 – 9 from 1961 Census population of age 0 – 4.

$$^{1966}P_5 = {}^{1961}P_0\left(1-\frac{d_0+d_1}{2}{}_{61-2}\right)\left(1-\frac{d_1+d_2}{2}{}_{62-3}\right)\left(1-\frac{d_2+d_3}{2}{}_{63-4}\right)\left(1-\frac{d_3+d_4}{2}{}_{64-5}\right)\left(1-\frac{d_4+d_5}{2}{}_{65-6}\right)$$

$$^{1966}P_6 = {}^{1961}P_1\left(1-\frac{d_1+d_2}{2}{}_{61-2}\right)\left(1-\frac{d_2+d_3}{2}{}_{62-3}\right)\left(1-\frac{d_3+d_4}{2}{}_{63-4}\right)\left(1-\frac{d_4+d_5}{2}{}_{64-5}\right)\left(1-d_{5,65-6}\right)$$

$$^{1966}P_7 = {}^{1961}P_2\left(1-\frac{d_2+d_3}{2}{}_{61-2}\right)\left(1-\frac{d_3+d_4}{2}{}_{62-3}\right)\left(1-\frac{d_4+d_5}{2}{}_{63-4}\right)\left(1-d_{5,65}\right)^2$$

$$^{1966}P_8 = {}^{1961}P_3\left(1-\frac{d_3+d_4}{2}{}_{61-2}\right)\left(1-\frac{d_4+d_5}{2}{}_{62-3}\right)\left(1-d_{5,64-5}\right)^3$$

$$^{1966}P_9 = {}^{1961}P_4\left(1-\frac{d_4+d_5}{2}{}_{61-2}\right)\left(1-d_{5,64}\right)^4$$

The formulae can be written in a more generalized form as

$$^{t+5}P_{i+5} = {}^{t}P_i \prod_{x=0}^{i+4}\left(1-\frac{d_{i+x}+d_{i+x+1}}{2}{}_{t+x+½}\right)$$

and for the age group 5 – 9 as a whole:

$$^{t+5}P_{5\to 9} = \sum_{i=0}^{4} {}^{t}P_i \prod_{x=0}^{i+4}\left(1-\frac{d_{i+x}+d_{i+x+1}}{2}{}_{t+x+½}\right)$$

3. *Survivorship of the Newly Born:*

Unlike the preceding two groups, which refer to persons at one point in time, the integration of newly born in the existing population must be considered as an inflow occurring during a period of time. For this reason the survivorship formulae had to be adapted to take into account this peculiarity. The following example illustrates the technique used for computing the survivorship at June 1, 1966, of those born between June 1, 1961, and June 1, 1966:

$$ {}^{1966}P_4 = {}^{1961-2}B\left(1-\tfrac{1}{2}d_{o,61-2}\right)\left(1-\frac{d_o+d_1}{2}{}_{62-3}\right)\left(1-\frac{d_1+d_2}{2}{}_{63-4}\right)\left(1-\frac{d_2+d_3}{2}{}_{64-5}\right)\left(1-\frac{d_3+d_4}{2}{}_{65-6}\right) $$

$$ {}^{1966}P_3 = {}^{1962-3}B\left(1-\tfrac{1}{2}d_{o,62-3}\right)\left(1-\frac{d_o+d_1}{2}{}_{63-4}\right)\left(1-\frac{d_1+d_2}{2}{}_{64-5}\right)\left(1-\frac{d_2+d_3}{2}{}_{65-6}\right) $$

$$ {}^{1966}P_2 = {}^{1963-4}B\left(1-\tfrac{1}{2}d_{o,63-4}\right)\left(1-\frac{d_o+d_1}{2}{}_{64-5}\right)\left(1-\frac{d_1+d_2}{2}{}_{65-6}\right) $$

$$ {}^{1966}P_1 = {}^{1964-5}B\left(1-\tfrac{1}{2}d_{o,64-5}\right)\left(1-\frac{d_o+d_1}{2}{}_{65-6}\right) $$

$$ {}^{1966}P_o = {}^{1965-6}B\left(1-\tfrac{1}{2}d_{o,65-6}\right) $$

4. *Estimation of the Number of Newly Born*

The number of newly born had to be estimated for every individual year within the quinquennium since, as pointed out above, the age specific death rates vary significantly from one age to the next during early infancy.

The number born in a year was derived by applying the age specific fertility rates to the corresponding female population. In this way, the number of born was estimated by using the formula:

$$ {}^{t}B = \sum_{i=15}^{45} {}^{t}F_i \; {}^{t+\frac{1}{4}}f_i $$

This formula could be applied only for the year at the beginning of each quinquennium when F_i is available. For the intervening years a kind of interpolation had to be used.

For this purpose it was decided to use the Newton interpolation formula:

$$ {}^{x}B = {}^{O}B + x\Delta^1 + \frac{x(x-1)}{2!}\Delta^2 + \frac{x(x-1)(x-2)}{3!}\Delta^3 + \ldots\ldots $$

where x represents the years in the quinquennium expressed as its fractions (1/5, 2/5, 3/5 and 4/5) and Δ represents the differences between B_O's of subsequent quinquennia.

For the last two quinquennia of the projection only the first and second differences were used, because the ones of the third degree were not available.

The next step was to split the number of newly born children into male and female groups. The ratio of male to female among the newly born shows a remarkable constancy. The average proportion of males in Canada during the last 40 years was .513951 and this ratio was used in the projection.

5. *Net Immigration*

The population is affected by three components of change:

a) aging,

b) reproduction, and

c) inflow of immigrants.

To estimate the number of immigrants belonging to a specific age at the end of a quinquennial period requires aggregation of persons entering and leaving each "age year". As an example, the immigrant population of age seven at the end of a quinquennium consists of the survivors of the following groups:

a) One half of the immigrants of age two and three entering country during the first year of the quinquennium,

b) one half of the immigrants of age three and four entering country during the second year of the quinquennium,

c) one half of the immigrants of age four and five entering country during the third year of the quinquennium,

d) one half of the immigrants of age five and six entering country during the fourth year of the quinquennium,

e) one half of the immigrants of age six and seven entering country during the fifth year of the quinquennium.

The above groupings can be stated in the following formula which also takes account of the mortality factor.

$$
\begin{aligned}
I_7 = {} & \frac{{}^{t}(I_2+I_3)}{2}\left(1-\frac{d_3+d_4}{2}\,{}_{t+\frac{1}{2}}\right)\left(1-\frac{d_4+d_5}{2}\,{}_{t+1\frac{1}{2}}\right)\left(1-d_{5-9,\,t+3}\right)^2\left(1-\frac{d_{5-9}}{2}\,{}_{t+4\frac{1}{2}}\right) \\
& + \frac{{}^{t+1}(I_3+I_4)}{2}\left(1-\frac{d_4+d_5}{2}\,{}_{t+1\frac{1}{2}}\right)\left(1-d_{5-9,\,t+3}\right)^2\left(1-\frac{d_{5-9}}{2}\,{}_{t+4\frac{1}{2}}\right) \\
& + \frac{{}^{t+2}(I_4+I_5)}{2}\left(1-d_{5-9,\,t+3}\right)^2\left(1-\frac{d_{5-9}}{2}\,{}_{t+4\frac{1}{2}}\right) \\
& + \frac{{}^{t+3}(I_5+I_6)}{2}\left(1-d_{5-9,\,t+3}\right)\left(1-\frac{d_{5-9}}{2}\,{}_{t+4\frac{1}{2}}\right) \\
& + \frac{{}^{t+4}(I_6+I_7)}{2}\left(1-\frac{d_{5-9}}{2}\,{}_{t+4\frac{1}{2}}\right)
\end{aligned}
$$

No time subscripts for I_i's are necessary since it is assumed that:

a) the *same number* of net immigrants enter the country each year and that

b) they have the same age distribution.

For the age groups beyond the 0–9 age interval, the survivorship and accumulation formulae of immigrants entering the country during the quinquennium became

computationally less heavy. Consider age group 20–24 at the end of a quinquennium. It consists of survivors composed of the following single ages:

$$
\begin{aligned}
I_{20-24} = {} & (\tfrac{1}{2} I_{15}+I_{16}+I_{17}+I_{18}+I_{19}+I_{20})(1-\tfrac{d}{2})(1-d)^4 \\
& + (\tfrac{1}{2} I_{16}+I_{17}+I_{18}+I_{19}+I_{20}+I_{21})(1-\tfrac{d}{2})(1-d)^3 \\
& + (\tfrac{1}{2} I_{17}+I_{18}+I_{19}+I_{20}+I_{21}+I_{22})(1-\tfrac{d}{2})(1-d)^2 \\
& + (\tfrac{1}{2} I_{18}+I_{19}+I_{20}+I_{21}+I_{22}+I_{23})(1-\tfrac{d}{2})(1-d)^1 \\
& + (\tfrac{1}{2} I_{19}+I_{20}+I_{21}+I_{22}+I_{23}+I_{24})(1-\tfrac{d}{2})
\end{aligned}
$$

This can be simplified into:

$$
\begin{aligned}
I_{20-24} = {} & (1-\tfrac{d}{2})(1-d)^4 \,[I_{15-19} - \tfrac{1}{2}I_{15} + \tfrac{1}{2}I_{20}] \\
& + (I-\tfrac{d}{2})(1-d)^3 \,[I_{15-19} - (I_{15}+\tfrac{1}{2}I_{16}) + (I_{20}+\tfrac{1}{2}I_{21})] \\
& + (I-\tfrac{d}{2})(1-d)^2 \,[I_{15-19} - (I_{15}+I_{16}+\tfrac{1}{2}I_{17}) + (I_{20}+I_{21}+\tfrac{1}{2}I_{22})] \\
& + (1-\tfrac{d}{2})(1-d)\,[I_{15-19} - (I_{15}+I_{16}+I_{17}+\tfrac{1}{2}I_{18}) + (I_{20}+I_{21}+I_{22}+\tfrac{1}{2}I_{23})] \\
& + (1-\tfrac{d}{2})\,[I_{15-19} - (I_{15}+I_{16}+I_{17}+I_{18}+\tfrac{1}{2}I_{19}) + (I_{20}+I_{21}+I_{22}+I_{23}+\tfrac{1}{2}I_{24})]
\end{aligned}
$$

which equals to:

$$
\begin{aligned}
I_{20-24} = {} & I_{15-19}\,(I-\tfrac{1}{2}d_{15-19})\,\frac{1-(1-d_{15-19})^5}{d} \\
& - (1-\tfrac{1}{2}d_{15-19}) \sum_{y=o}^{4} I_{15+y}\,\frac{1-(1-d_{15-19})^{5-y}}{d} \\
& + \tfrac{1}{2}(1-\tfrac{1}{2}d_{15-19}) \sum_{y=o}^{4} I_{15+y}\,(1-d_{15-19})^{4-y} \\
& - (1-\tfrac{1}{2}d_{20-24}) \sum_{y=o}^{4} I_{20+y}\,\frac{1-(1-d_{20-24})^{5-y}}{d} \\
& + \tfrac{1}{2}(1-\tfrac{1}{2}d_{20-24}) \sum_{y=o}^{4} I_{20+y}\,(1-d_{20-24})^{4-y}
\end{aligned}
$$

This last formula was used in computing the immigrant survivors which were in the age group at the beginning of the subsequent quinquennium.

6. In the projection, the immigrants were added at the end of each subsequent quinquennium to the population already in Canada and treated from then on in respect to the mortality and fertility rates as the part of it.

APPENDIX E

Tables 1 — 16

TABLE 1

POPULATION OF CANADA,
CENSUS, JUNE 1, 1961

Age Group	Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent
0– 4	1,154,091	12.52	1,102,310	12.22	2,256,401	12.37
5– 9	1,063,840	11.54	1,015,682	11.26	2,079,522	11.40
10–14	948,160	10.28	907,839	10.07	1,855,999	10.18
15–19	729,035	7.91	703,524	7.80	1,432,559	7.86
20–24	587,139	6.37	596,507	6.61	1,183,646	6.49
25–29	613,897	6.66	595,400	6.60	1,209,297	6.63
30–34	644,407	6.99	627,403	6.96	1,271,810	6.97
35–39	631,072	6.85	639,852	7.09	1,270,924	6.97
40–44	559,996	6.07	558,965	6.20	1,118,961	6.14
45–49	515,516	5.59	499,800	5.54	1,015,316	5.57
50–54	442,909	4.80	420,279	4.66	863,188	4.73
55–59	362,145	3.93	343,690	3.81	705,835	3.87
60–64	292,569	3.17	291,066	3.23	583,635	3.20
65–69	239,685	2.60	247,417	2.74	487,102	2.67
70–74	196,076	2.13	206,099	2.28	402,175	2.21
75–79	134,186	1.46	140,051	1.55	274,237	1.50
80–84	69,046	0.75	77,771	0.86	146,817	0.80
85+	35,124	0.38	45,699	0.52	80,823	0.44
Total	9,218,893	100.00	9,019,354	100.00	18,238,247	100.00

TABLE 2

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 0 per annum)

Age	June 1, 1966						June 1, 1971					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0– 4	1,209.1	11.98	1,151.5	11.59	2,360.6	11.79	1,333.8	12.07	1,268.4	11.60	2,602.2	11.84
5– 9	1,145.5	11.35	1,096.5	11.04	2,242.0	11.20	1,201.0	10.87	1,146.2	10.49	2,347.2	10.68
10–14	1,059.7	10.50	1,013.8	10.21	2,073.5	10.36	1,141.4	10.33	1,094.6	10.02	2,236.0	10.17
15–19	945.5	9.38	906.6	9.13	1,852.1	9.25	1,056.9	9.56	1,012.5	9.26	2,069.4	9.41
20–24	724.8	7.18	701.9	7.07	1,426.7	7.13	940.2	8.51	904.7	8.27	1,844.9	8.39
25–29	582.9	5.78	594.8	5.99	1,177.7	5.88	719.8	6.51	700.0	6.40	1,419.8	6.46
30–34	609.4	6.05	593.4	5.97	1,202.8	6.01	578.9	5.24	592.9	5.42	1,171.8	5.33
35–39	639.5	6.34	624.7	6.28	1,264.2	6.31	605.0	5.47	591.0	5.41	1,196.0	5.44
40–44	624.2	6.19	635.4	6.40	1,259.6	6.29	632.8	5.73	620.6	5.68	1,253.4	5.70
45–49	551.1	5.46	553.3	5.57	1,104.4	5.52	614.7	5.56	629.4	5.76	1,244.1	5.66
50–54	500.8	4.96	491.4	4.95	992.2	4.96	535.7	4.85	544.4	4.98	1,080.1	4.91
55–59	422.7	4.19	409.5	4.12	832.2	4.16	478.2	4.33	479.2	4.38	957.4	4.36
60–64	335.0	3.32	330.3	3.33	665.3	3.32	391.2	3.54	394.1	3.60	785.3	3.57
65–69	258.8	2.57	272.5	2.74	531.3	2.65	296.5	2.68	309.7	2.83	606.2	2.76
70–74	199.9	1.98	222.5	2.24	422.4	2.11	216.1	1.96	246.0	2.25	462.1	2.10
75–79	148.7	1.47	172.6	1.74	321.3	1.60	151.9	1.37	187.3	1.71	339.2	1.54
80–84	87.2	0.86	103.5	1.04	190.7	0.95	96.9	0.88	128.8	1.18	225.7	1.03
85 +	44.0	0.44	58.5	0.59	102.5	0.51	59.6	0.54	83.4	0.76	143.0	0.65
Total	10,088.8	100.00	9,932.7	100.00	20,021.5	100.00	11,050.6	100.00	10,933.2	100.00	21,983.8	100.00

TABLE 2 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 0 per annum)

Age	June 1, 1976						June 1, 1981					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0– 4	1,531.3	12.58	1,456.4	12.05	2,987.7	12.32	1,740.1	12.93	1,654.1	12.35	3,394.2	12.63
5– 9	1,324.8	10.89	1,263.3	10.46	2,588.1	10.67	1,523.2	11.31	1,451.2	10.84	2,974.4	11.07
10–14	1,197.2	9.84	1,144.4	9.47	2,341.6	9.65	1,321.1	9.81	1,261.5	9.42	2,582.6	9.62
15–19	1,138.7	9.36	1,093.5	9.05	2,232.2	9.20	1,194.7	8.87	1,143.4	8.54	2,338.1	8.71
20–24	1,051.5	8.64	1,010.7	8.36	2,062.2	8.50	1,133.3	8.42	1,091.8	8.15	2,225.1	8.28
25–29	934.3	7.68	902.5	7.47	1,836.8	7.57	1,045.2	7.76	1,008.4	7.53	2,053.6	7.65
30–34	715.2	5.88	697.9	5.78	1,413.1	5.83	928.7	6.90	899.9	6.72	1,828.6	6.81
35–39	575.0	4.72	590.7	4.89	1,165.7	4.81	710.6	5.28	695.6	5.19	1,406.2	5.24
40–44	599.1	4.92	587.3	4.86	1,186.4	4.89	569.7	4.23	587.2	4.38	1,156.9	4.31
45–49	623.6	5.12	615.1	5.09	1,238.7	5.11	590.8	4.39	582.5	4.35	1,173.3	4.37
50–54	597.8	4.91	619.6	5.13	1,217.4	5.02	606.9	4.51	606.0	4.52	1,212.9	4.52
55–59	511.8	4.21	531.3	4.40	1,043.1	4.30	571.5	4.24	605.3	4.52	1,176.8	4.38
60–64	442.8	3.64	461.9	3.82	904.7	3.73	474.1	3.52	513.0	3.83	987.1	3.67
65–69	346.2	2.84	370.1	3.06	716.3	2.95	391.9	2.91	434.4	3.24	826.3	3.07
70–74	247.6	2.03	280.7	2.32	528.3	2.18	289.3	2.15	336.7	2.51	626.0	2.33
75–79	164.4	1.35	208.1	1.72	372.5	1.54	188.6	1.40	238.5	1.78	427.1	1.59
80–84	99.1	0.81	140.9	1.17	240.0	0.99	107.4	0.80	157.9	1.18	265.3	0.99
85+	70.4	0.58	108.4	0.90	178.8	0.74	76.6	0.57	127.4	0.95	204.0	0.76
Total	12,170.8	100.00	12,082.8	100.00	24,253.6	100.00	13,463.7	100.00	13,394.8	100.00	26,858.5	100.00

TABLE 2 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 0 per annum)

Age	June 1, 1986						June 1, 1991					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0– 4	1,907.2	12.81	1,812.0	12.22	3,719.2	12.52	2,060.6	12.55	1,956.2	11.96	4,016.8	12.25
5– 9	1,731.9	11.64	1,649.0	11.12	3,380.9	11.38	1,899.3	11.57	1,807.0	11.04	3,706.3	11.30
10–14	1,519.5	10.21	1,449.5	9.77	2,969.0	9.99	1,728.3	10.53	1,647.4	10.06	3,375.7	10.30
15–19	1,318.7	8.86	1,260.6	8.50	2,579.3	8.68	1,517.1	9.24	1,448.6	8.85	2,965.7	9.05
20–24	1,189.4	7.99	1,141.9	7.70	2,331.3	7.85	1,313.3	8.00	1,259.3	7.69	2,572.6	7.85
25–29	1,127.0	7.57	1,089.5	7.35	2,216.5	7.46	1,183.3	7.21	1,139.8	6.96	2,323.1	7.09
30–34	1,039.4	6.98	1,005.7	6.78	2,045.1	6.88	1,121.2	6.83	1,086.8	6.64	2,208.0	6.73
35–39	923.1	6.20	897.2	6.05	1,820.3	6.13	1,033.6	6.30	1,003.0	6.13	2,036.6	6.21
40–44	704.4	4.73	691.7	4.66	1,396.1	4.70	915.6	5.58	892.6	5.45	1,808.2	5.52
45–49	562.1	3.78	582.7	3.93	1,144.8	3.85	695.6	4.23	686.8	4.20	1,382.4	4.22
50–54	575.3	3.87	574.2	3.87	1,149.5	3.87	547.8	3.34	574.8	3.51	1,122.6	3.42
55–59	580.6	3.90	592.4	3.99	1,173.0	3.94	550.6	3.35	561.9	3.43	1,112.5	3.39
60–64	529.7	3.56	585.3	3.95	1,115.0	3.75	538.2	3.28	573.7	3.50	1,111.9	3.39
65–69	419.6	2.82	483.2	3.26	902.8	3.04	468.8	2.86	552.1	3.37	1,020.9	3.11
70–74	327.7	2.20	396.8	2.68	724.5	2.44	351.2	2.14	443.0	2.71	794.2	2.42
75–79	220.7	1.48	287.5	1.94	508.2	1.71	250.4	1.53	340.4	2.08	590.8	1.80
80–84	123.5	0.83	182.5	1.23	306.0	1.03	144.7	0.88	221.9	1.36	366.6	1.12
85 + ...	84.8	0.57	148.6	1.00	233.4	0.78	96.8	0.58	174.2	1.06	271.0	0.83
Total	14,884.6	100.00	14,830.3	100.00	29,714.9	100.00	16,416.4	100.00	16,369.5	100.00	32,785.9	100.00

TABLE 3

POPULATION OF CANADA, (Thousands of Persons),
SELECTED AGE GROUPS, 1961

Population Groups	Age Group	June 1, 1961					
		Male		Female		Total	
		No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,154.1	12.52	1,102.3	12.22	2,256.4	12.37
Elementary school	5–14	2,012.0	21.82	1,923.5	21.33	3,935.5	21.58
High school	15–19	729.0	7.91	703.5	7.80	1,432.6	7.85
University	20–24	587.1	6.37	596.5	6.61	1,183.6	6.49
Labour Force Recruiting	15–24	1,316.2	14.28	1,300.0	14.41	2,616.2	14.34
Population of Working Age	15–64	5,378.7	58.34	5,276.5	58.50	10,655.2	58.42
Elderly	65+	674.1	7.31	717.0	7.95	1,391.2	7.63
Dependent	0–14, 65+	3,840.2	41.66	3,742.8	41.50	7,583.1	41.58
Main Family Formation Ages	20–29	1,201.0	13.03	1,191.9	13.21	2,392.9	13.12

TABLE 4

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 0 per annum)

Population Groups	Age Group	June 1, 1966						June 1, 1971					
		Male		Female		Total		Male		Female		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,209.1	11.98	1,151.5	11.59	2,360.6	11.79	1,333.8	12.07	1,268.4	11.60	2,602.2	11.84
Elementary school	5–14	2,205.2	21.86	2,110.3	21.25	4,315.5	21.55	2,342.4	21.20	2,240.8	20.50	4,583.2	20.85
High school	15–19	945.5	9.38	906.6	9.13	1,852.1	9.25	1,056.9	9.56	1,012.5	9.26	2,069.4	9.41
University	20–24	724.8	7.18	701.9	7.07	1,426.7	7.13	940.2	8.51	904.7	8.27	1,844.9	8.39
Labour Force Recruiting	15–24	1,670.3	16.56	1,608.5	16.19	3,278.8	16.38	1,997.1	18.07	1,917.2	17.54	3,914.3	17.81
Population of Working Age	15–64	5,935.9	58.84	5,841.3	58.81	11,777.2	58.82	6,553.4	59.30	6,468.8	59.17	13,022.2	59.24
Elderly	65+	738.6	7.32	829.6	8.35	1,568.2	7.83	821.0	7.43	955.2	8.74	1,776.2	8.08
Dependent	0–14, 65+	4,152.9	41.16	4,091.4	41.19	8,244.3	41.18	4,497.2	40.70	4,464.4	40.83	8,961.6	40.76
Main Family Formation Ages	20–29	1,307.7	12.96	1,296.7	13.05	2,604.4	13.01	1,660.0	15.02	1,604.7	14.68	3,264.7	14.85

TABLE 4 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 0 per annum)

Population Groups	Age Group	June 1, 1976						June 1, 1981					
		Male		Female		Total		Male		Female		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,531.3	12.58	1.456.4	12.05	2,987.7	12.32	1,740.1	12.93	1,654.1	12.35	3,394.2	12.63
Elementary school	5–14	2,522.0	20.72	2.407.7	19.93	4,929.7	20.33	2,844.3	21.13	2,712.7	20.25	5,557.0	20.69
High school	15–19	1,138.7	9.36	1,093.5	9.05	2,232.2	9.20	1,194.7	8.87	1,143.4	8.54	2,338.1	8.71
University	20–24	1,051.5	8.64	1,010.7	8.36	2,062.2	8.50	1,133.3	8.42	1,091.8	8.15	2,225.1	8.28
Labour Force Recruiting	15–24	2,190.0	18.00	2,104.2	17.41	4,294.4	17.71	2,328.0	17.29	2,235.2	16.69	4,563.2	16.99
Population of Working Age ...	15–64	7,189.8	59.07	7,110.5	58.85	14,300.3	58.96	7,825.5	58.12	7,733.1	57.73	15,558.6	57.93
Elderly	65+	927.7	7.62	1,108.2	9.17	2,035.9	8.39	1,053.8	7.83	1,294.9	9.67	2,348.7	8.74
Dependent	0–14, 65+	4,981.0	40.93	4,972.3	41.15	9,953.3	41.04	5,638.2	41.88	5,661.7	42.27	11,299.9	42.07
Main Family Formation Ages	20–29	1,985.8	16.32	1,913.2	15.83	3,899.0	16.08	2,178.5	16.18	2,100.2	15.68	4,278.7	15.93

TABLE 4 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 0 per annum)

Population Groups	Age Group	June 1, 1986						June 1, 1991					
		Male		Female		Total		Male		Female		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,907.2	12.81	1,812.0	12.22	3,719.2	12.52	2,060.6	12.55	1,956.2	11.96	4,016.8	12.25
Elementary school	5–14	3,251.4	21.84	3,098.5	20.89	6,349.9	21.37	3,627.6	22.10	3,454.4	21.10	7,082.0	21.60
High school	15–19	1,318.7	8.86	1,260.6	8.50	2,579.3	8.68	1,517.1	9.24	1,448.6	8.85	2,965.7	9.05
University	20–24	1,189.4	7.99	1,141.9	7.70	2,331.3	7.85	1.313.3	8.00	1,259.3	7.69	2,572.6	7.85
Labour Force Recruiting	15–24	2,508.1	16.85	2,402.5	16.20	4,910.6	16.53	2,830.4	17.24	2,707.9	16.54	5,538.3	16.89
Population of Working Age ...	15–64	8,549.7	57.44	8,421.2	56.78	16,970.9	57.11	9,416.3	57.36	9,227.3	56.37	18,643.6	56.86
Elderly	65+	1,176.3	7.90	1,498.6	10.10	2,674.9	9.00	1,311.9	7.99	1,731.6	10.58	3,043.5	9.28
Dependent	0–14, 65+	6,334.9	42.56	6,409.1	43.22	12,744.0	42.89	7,000.1	42.64	7,142.2	43.63	14,142.3	43.14
Main Family Formation Ages	20–29	2,316.4	15.56	2,231.4	15.05	4,547.8	15.30	2,496.6	15.21	2,399.1	14.66	4,895.7	14.93

TABLE 5

MORTALITY RATES PER 1,000 POPULATION

Age	1961–1966		1966–1971		1971–1976		1976–1981		1981–1986		1986–1991	
	M.	F.	M.	F.	M,	F.	M.	F.	M.	F.	M.	F.
0	30.4000	23.0000	26.2000	19.3000	23.0000	16.7000	20.4000	14.8000	18.7000	13.5000	17.4000	13.1000
1	1.8300	1.5200	1.4200	1.1800	1.1500	0.9800	0.9200	0.8200	0.7800	0.7000	0.7200	0.6500
2	1.0800	0.9700	0.9630	0.8720	0.8660	0.7730	0.7690	0.6750	0.6720	0.5760	0.5760	0.4770
3	0.9800	0.8000	0.8780	0.7140	0.8000	0.6280	0.7220	0.5420	0.6440	0.4560	0.5640	0.3700
4	0.8700	0.5900	0.7880	0.5230	0.7280	0.4560	0.6680	0.3880	0.6080	0.3210	0.5480	0.2540
5–9	0.7800	0.3800	0.7060	0.3460	0.6320	0.3120	0.5580	0.2780	0.4840	0.2440	0.4100	0.2000
10–14	0.5700	0.2800	0.5200	0.2460	0.4700	0.2120	0.4200	0.1780	0.3700	0.1440	0.3200	0.1100
15–19	1.1800	0.4600	1.1080	0.4100	1.0360	0.3600	0.9640	0.3100	0.8920	0.2600	0.8200	0.2100
20–24	1.4400	0.5800	1.3680	0.5400	1.2760	0.5000	1.1940	0.4600	1.1120	0.4200	1.0300	0.3800
25–29	1.4600	0.6900	1.3740	0.6520	1.2880	0.6140	1.2020	0.5760	1.1160	0.5380	1.0300	0.5000
30–34	1.5400	0.8500	1.4560	0.7860	1.3700	0.7220	1.2880	0.6580	1.2040	0.5940	1.1200	0.5300
35–39	2.2000	1.4000	2.0840	1.3260	1.9680	1.2520	1.8520	1.1780	1.7360	1.1040	1.6200	1.0300
40–44	3.2000	2.0200	3.0660	1.9000	2.9320	1.7800	2.7980	1.6600	2.6640	1.5400	2.5300	1.4200
45–49	5.7800	3.3800	5.6540	3.2480	5.5280	3.1160	5.4020	2.9840	5.2700	2.8520	5.1500	2.7200
50–54	9.3100	5.2000	9.1960	5.0280	9.0820	4.8560	8.9680	4.6840	8.8500	4.5120	8.7400	4.3400
55–59	15.4300	7.9100	15.3480	7.6080	15.2600	7.3060	15.1840	7.0040	15.1020	6.7020	15.0200	6.4000
60–64	24.2000	13.0800	24.1800	12.7840	24.1600	12.4880	24.1400	12.1920	24.1200	11.8960	24.1000	11.6000
65–69	35.6000	21.0000	35.4800	20.2400	35.3600	19.4800	35.2400	18.7200	35.1200	17.9600	35.0000	17.2000
70–74	53.8000	34.8000	53.5200	33.8800	53.2400	32.9600	52.9600	32.0400	52.6800	31.1200	52.4000	30.2000
75–79	82.5000	58.6000	82.2000	56.9800	81.9000	55.3600	81.6000	53.7400	81.3000	52.1200	81.0000	50.5000
80–84	130.0000	105.6000	127.7200	104.9200	126.5800	104.2400	126.5800	103.5600	125.4400	102.8800	124.3000	102.2000
85+	228.7000	210.8000	226.9800	208.7600	225.2300	206.7200	223.5040	204.6800	221.7720	202.6400	220.0400	200.6000

TABLE 6

FERTILITY RATES PER 1,000 WOMEN

Year	Age Groups							Total Fertility	Gross Reproduction Rate
	15–19	20–24	25–29	30–34	35–39	40–44	45–49		
1961–62	59.900	229.000	227.000	145.200	85.900	28.000	2.400	3,887	1.889
1966–67	60.435	228.750	226.200	141.900	84.200	27.100	2.330	3,855	1.874
1971–72	60.970	228.500	225.000	139.200	82.600	26.200	2.260	3,824	1.858
1976–77	61.505	227.200	223.000	137.200	81.000	25.400	2.190	3,787	1.841
1981–82	62.040	225.800	220.500	135.500	79.200	24.600	2.120	3,749	1.822
1986–87	62.573	221.700	216.300	134.200	77.800	23.800	2.050	3,692	1.795
1991–92	63.000	219.000	212.000	134.000	76.000	23.000	2.000	3,645	1.772

TABLE 7

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 10,000 per annum)

Age Group	June 1, 1966						June 1, 1971					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,212.8	11.99	1,155.0	11.60	2,367.8	11.79	1,343.6	12.09	1,277.7	11.62	2,621.3	11.86
5 – 9	1,147.8	11.35	1,098.8	11.03	2,246.6	11.19	1,207.1	10.86	1,152.0	10.48	2,359.1	10.67
10 – 14	1,061.5	10.49	1,015.4	10.20	2,076.9	10.34	1,145.5	10.31	1,098.5	9.99	2,244.0	10.15
15 – 19	946.9	9.36	907.9	9.12	1,854.8	9.24	1,060.1	9.54	1,015.5	9.24	2,075.6	9.39
20 – 24	728.4	7.20	705.3	7.08	1,433.7	7.14	945.3	8.51	909.5	8.28	1,854.8	8.39
25 – 29	588.0	5.81	599.4	6.02	1,187.4	5.91	728.5	6.56	708.0	6.44	1,436.5	6.50
30 – 34	613.2	6.06	596.8	5.99	1,210.0	6.03	587.7	5.29	600.8	5.47	1,188.5	5.38
35 – 39	641.9	6.34	626.9	6.29	1,268.8	6.32	611.2	5.50	596.6	5.43	1,207.8	5.46
40 – 44	625.6	6.18	636.7	6.39	1,262.3	6.29	636.7	5.73	624.1	5.68	1,260.8	5.70
45 – 49	552.0	5.46	554.2	5.56	1,106.2	5.51	617.0	5.55	631.5	5.74	1,248.5	5.65
50 – 54	501.4	4.96	492.1	4.94	993.5	4.95	537.2	4.83	546.0	4.97	1,083.2	4.90
55 – 59	423.1	4.18	410.0	4.12	833.1	4.15	479.2	4.31	480.4	4.37	959.6	4.34
60 – 64	335.3	3.31	330.8	3.32	666.1	3.32	391.8	3.53	395.1	3.59	786.9	3.56
65 – 69	259.0	2.56	272.8	2.74	531.8	2.65	296.9	2.67	310.4	2.82	607.3	2.75
70 – 74	200.1	1.98	222.7	2.24	422.8	2.11	216.3	1.95	246.5	2.24	462.8	2.09
75 + ...	280.0	2.77	334.8	3.36	614.8	3.06	308.5	2.77	399.8	3.64	708.3	3.21
Total	10,117.0	100.00	9,959.6	100.00	20,076.6	100.00	11,112.6	100.00	10,992.4	100.00	22,105.0	100.00

TABLE 7 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 10,000 per annum)

Age Group	June 1, 1976						June 1, 1981					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,546.0	12.60	1,470.3	12.07	3,016.3	12.34	1,758.8	12.93	1,672.0	12.36	3,430.8	12.64
5 – 9	1,336.9	10.89	1,274.8	10.47	2,611.7	10.68	1,540.2	11.32	1,467.3	10.84	3,007.5	11.08
10 – 14	1,205.0	9.82	1,151.8	9.46	2,356.8	9.64	1,334.9	9.81	1,274.6	9.42	2,609.5	9.62
15 – 19	1,144.3	9.33	1,098.7	9.02	2,243.0	9.17	1,203.9	8.85	1,152.2	8.52	2,356.1	8.68
20 – 24	1,058.3	8.62	1,017.1	8.35	2,075.4	8.49	1,142.4	8.40	1,100.4	8.13	2,242.8	8.27
25 – 29	944.4	7.69	911.8	7.49	1,856.2	7.59	1,057.1	7.77	1,019.3	7.54	2,076.4	7.65
30 – 34	727.6	5.93	709.2	5.82	1,436.8	5.88	942.5	6.93	912.6	6.74	1,855.1	6.84
35 – 39	586.1	4.78	600.8	4.93	1,186.9	4.85	725.3	5.33	709.0	5.24	1,434.3	5.29
40 – 44	606.6	4.94	594.2	4.88	1,200.8	4.92	582.2	4.28	598.6	4.42	1,180.8	4.35
45 – 49	628.3	5.12	619.4	5.09	1,247.7	5.10	599.1	4.40	590.1	4.36	1,189.2	4.38
50 – 54	600.8	4.90	622.5	5.11	1,223.3	5.00	612.1	4.50	610.9	4.52	1,223.0	4.51
55 – 59	513.6	4.19	533.4	4.38	1,047.0	4.28	574.7	4.22	608.6	4.50	1,183.3	4.36
60 – 64	443.9	3.62	463.6	3.81	907.5	3.71	476.1	3.50	515.4	3.81	991.5	3.65
65 – 69	346.9	2.83	371.3	3.05	718.2	2.94	393.1	2.89	436.3	3.22	829.4	3.06
70 – 74	248.1	2.02	281.6	2.31	529.7	2.17	290.0	2.13	338.1	2.50	628.1	2.31
75 + ...	334.2	2.72	458.1	3.76	792.3	3.24	373.2	2.74	525.1	3.88	898.3	3.31
Total	12,271.0	100.00	12,178.6	100.00	24,449.6	100.00	13,605.6	100.00	13,530.5	100.00	27,136.1	100.00

TABLE 7 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 10,000 per annum)

Age Group	June 1, 1986						June 1, 1991					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,930.2	12.81	1,833.8	12.22	3,764.0	12.51	2,089.3	12.55	1,983.4	11.95	4,072.7	12.25
5 – 9	1,752.9	11.63	1,669.0	11.12	3,421.9	11.38	1,924.5	11.56	1,831.0	11.03	3,755.5	11.29
10 – 14	1,538.2	10.20	1,467.2	9.77	3,005.4	9.99	1,751.1	10.52	1,669.0	10.06	3,420.1	10.29
15 – 19	1,333.9	8.85	1,275.1	8.50	2,609.0	8.67	1,537.2	9.23	1,467.8	8.84	3,005.0	9.04
20 – 24	1,202.2	7.98	1,154.0	7.69	2,356.2	7.83	1,332.1	8.00	1,277.1	7.69	2,609.2	7.85
25 – 29	1,141.1	7.57	1,102.7	7.35	2,243.8	7.46	1,201.1	7.21	1,156.5	6.97	2,357.6	7.09
30 – 34	1,055.0	7.00	1,020.0	6.80	2,075.0	6.90	1,139.1	6.84	1,103.3	6.65	2,242.4	6.74
35 – 39	939.3	6.23	912.0	6.08	1,851.3	6.15	1,051.5	6.31	1,019.5	6.14	2,071.0	6.23
40 – 44	720.5	4.78	706.4	4.70	1,426.9	4.74	933.1	5.60	908.6	5.47	1,841.7	5.54
45 – 49	575.4	3.82	594.9	3.96	1,170.3	3.89	712.3	4.28	702.3	4.23	1,414.6	4.25
50 – 54	584.1	3.88	582.5	3.88	1,166.6	3.88	561.3	3.37	587.5	3.54	1,148.8	3.46
55 – 59	585.9	3.88	597.8	3.98	1,183.7	3.94	559.4	3.36	570.5	3.44	1,129.9	3.40
60 – 64	532.8	3.54	588.9	3.92	1,121.7	3.73	543.4	3.26	579.4	3.49	1,122.8	3.38
65 – 69	421.5	2.80	485.8	3.24	907.3	3.02	471.8	2.83	555.8	3.35	1,027.6	3.09
70 – 74	328.8	2.18	398.7	2.66	727.5	2.42	352.9	2.12	445.7	2.69	798.6	2.40
75 + ...	429.8	2.85	620.6	4.13	1,050.4	3.49	493.2	2.96	739.4	4.46	1,232.6	3.70
Total	15,071.6	100.00	15,009.4	100.00	30,081.0	100.00	16,653.3	100.00	16,596.8	100.00	33,250.1	100.00

TABLE 8

PROJECTED POPULATION OF CANADA (Thousands of Persons)
SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 10,000 per annum)

Population Groups	Age Group	June 1, 1966						June 1, 1971					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,212.8	11.99	1,155.0	11.60	2,367.8	11.79	1,343.6	12.09	1,277.7	11.62	2,621.3	11.86
Elementary school	5–14	2,209.3	21.84	2,114.2	21.23	4,323.5	21.54	2,352.6	21.17	2,250.5	20.47	4,603.1	20.82
High school	15–19	946.9	9.36	907.9	9.12	1,854.8	9.24	1,060.1	9.54	1,015.5	9.24	2,075.6	9.39
University	20–24	728.4	7.20	705.3	7.08	1,433.7	7.14	945.3	8.51	909.5	8.28	1,854.8	8.39
Labour Force Recruiting	15–24	1,675.3	16.56	1,613.2	16.20	3,288.5	16.38	2,005.4	18.05	1,925.0	17.51	3,930.4	17.78
Labour Force	15–64	5,955.8	58.87	5,860.1	58.84	11,815.9	58.85	6,594.7	59.34	6,507.5	59.20	13,102.2	59.27
Elderly	65+	739.1	7.31	830.3	8.34	1,569.4	7.82	821.7	7.39	956.7	8.70	1,778.4	8.05
Dependent	0–14, 65+	4,161.2	41.13	4,099.5	41.16	8,260.7	41.15	4,517.9	40.66	4,484.9	40.80	9,002.8	40.73
Main Family Formation Ages	20–29	1,316.4	13.01	1,304.7	13.10	2,621.1	13.06	1,673.8	15.06	1,617.5	14.71	3,291.3	14.89

TABLE 8 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 10,000 per annum)

Population Groups	Age Group	June 1, 1976						June 1, 1981					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,546.0	12.60	1,470.3	12.07	3,016.3	12.34	1,758.8	12.93	1,672.0	12.36	3,430.8	12.64
Elementary school	5–14	2,541.9	20.71	2,426.6	19.93	4,968.5	20.32	2,875.1	21.13	2,741.9	20.26	5,617.0	20.70
High school	15–19	1,144.3	9.33	1,098.7	9.02	2,243.0	9.17	1,203.9	8.85	1,152.2	8.52	2,356.1	8.68
University	20–24	1,058.3	8.62	1,017.1	8.35	2,075.4	8.49	1,142.4	8.40	1,100.4	8.13	2,242.8	8.27
Labour Force Recruiting	15–24	2,202.6	17.95	2,115.8	17.37	4,318.4	17.66	2,346.3	17.25	2,252.6	16.65	4,598.9	16.95
Labour Force	15–64	7,253.9	59.11	7,170.7	58.88	14,424.6	59.00	7,915.4	58.18	7,817.1	57.77	15,732.5	57.98
Elderly	65+	929.2	7.57	1,111.0	9.12	2,040.2	8.34	1,056.3	7.76	1,299.5	9.60	2,355.8	8.68
Dependent	0–14, 65+	5,017.1	40.89	5,007.9	41.12	10,025.0	41.00	5,690.2	41.82	5,713.4	42.23	11,403.6	42.02
Main Family Formation Ages	20–29	2,002.7	16.32	1,928.9	15.84	3,931.6	16.08	2,199.5	16.17	2,119.7	15.67	4,319.2	15.92

TABLE 8 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons),
SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 10,000 per annum)

Population Groups	Age Group	June 1, 1986						June 1, 1991					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0– 4	1,930.2	12.81	1,833.8	12.22	3,764.0	12.51	2,089.3	12.55	1,983.4	11.95	4,072.7	12.25
Elementary school	5–14	3,291.1	21.84	3,136.2	20.89	6,427.3	21.37	3,675.6	22.07	3,500.0	21.09	7,175.6	21.58
High school	15–19	1,333.9	8.85	1,275.1	8.50	2,609.0	8.67	1,537.2	9.23	1,467.8	8.84	3,005.0	9.04
University	20–24	1,202.2	7.98	1,154.0	7.69	2,356.2	7.83	1,332.1	8.00	1,277.1	7.69	2,609.2	7.85
Labour Force Recruiting .	15–24	2,536.1	16.83	2,429.1	16.18	4,965.2	16.51	2,869.3	17.23	2,744.9	16.54	5,614.2	16.88
Labour Force...........	15–64	8,670.2	57.53	8,534.3	56.86	17,204.5	57.19	9,570.5	57.47	9,372.5	56.47	18,943.0	56.97
Elderly	65+	1,180.1	7.83	1,505.1	10.03	2,685.2	8.93	1,317.9	7.91	1,740.9	10.49	3,058.8	9.20
Dependent	0–14, 65+	6,401.4	42.47	6,475.1	43.14	12,876.5	42.81	7,082.8	42.53	7,224.3	43.53	14,307.1	43.03
Main Family Formation Ages.......	20–29	2,343.3	15.55	2,256.7	15.04	4,600.0	15,29	2,533.2	15.21	2,433.6	14.66	4,966.8	14.94

TABLE 9

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 25,000 per annum)

Age Group	June 1, 1966						June 1, 1971					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0–4.............	1,218.4	11.99	1,160.3	11.60	2,378.7	11.80	1,358.3	12.12	1,291.7	11.66	2,650.0	11.89
5–9.............	1,151.3	11.33	1,102.1	11.02	2,253.4	11.18	1,216.1	10.85	1,160.5	10.47	2,376.6	10.66
10–14	1,064.1	10.48	1,017.9	10.18	2,082.0	10.33	1,151.6	10.28	1,104.3	9.97	2,255.9	10.12
15–19	949.1	9.34	910.0	9.10	1,859.1	9.22	1,064.9	9.50	1,020.0	9.20	2,084.9	9.36
20–24	733.9	7.23	710.4	7.11	1,444.3	7.16	953.0	8.51	916.6	8.27	1,869.6	8.39
25–29	595.5	5.86	606.3	6.06	1,201.8	5.96	741.5	6.62	720.0	6.50	1,461.5	6.56
30–34	618.9	6.09	601.8	6.02	1,220.7	6.06	600.9	5.36	612.8	5.53	1,213.7	5.45
35–39	645.5	6.35	630.1	6.30	1,275.6	6.33	620.5	5.54	604.9	5.46	1,225.4	5.50
40–44	627.8	6.18	638.7	6.39	1,266.5	6.28	642.4	5.73	629.2	5.68	1,271.6	5.71
45–49	553.4	5.45	555.5	5.56	1,108.9	5.50	620.5	5.54	634.8	5.73	1,255.3	5.63
59–54	502.3	4.95	493.2	4.93	995.5	4.94	539.5	4.82	548.4	4.95	1,087.9	4.88
55–59	423.6	4.17	410.9	4.11	834.5	4.14	480.6	4.29	482.3	4.35	962.9	4.32
60–64	335.7	3.30	331.4	3.31	667.1	3.31	392.7	3.50	396.5	3.58	789.2	3.54
65–69	259.3	2.55	273.3	2.73	532.6	2.64	297.5	2.65	311.5	2.81	609.0	2.73
70–74	200.2	1.97	223.0	2.23	423.2	2.10	216.7	1.93	247.3	2.23	464.0	2.08
75+	280.1	2.76	335.0	3.35	615.1	3.05	308.8	2.76	400.4	3.61	709.2	3.18
Total......	10,159.1	100.00	9,999.9	100.00	20,159.0	100.00	11,205.5	100.00	11,081.2	100.00	22,286.7	100.00

TABLE 9 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 25,000 per annum)

Age Group	June 1, 1976						June 1, 1981					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,568.0	12.62	1,491.3	12.10	3,059.3	12.36	1,787.0	12.93	1,698.7	12.37	3,485.7	12.65
5 – 9	1,355.0	10.91	1,292.0	10.49	2,647.0	10.70	1,565.6	11.33	1,491.5	10.86	3,057.1	11.10
10 – 14........	1,216.6	9.79	1,162.9	9.44	2,379.5	9.62	1,355.6	9.81	1,294.3	9.42	2,649.9	9.62
15 – 19.........	1,152.6	9.28	1,106.5	8.98	2,259.1	9.13	1,217.7	8.81	1,165.2	8.48	2,382.9	8.65
20 – 24.........	1,068.6	8.60	1,026.6	8.33	2,095.2	8.47	1,156.2	8.37	1,113.3	8.11	2,269.5	8.24
25 – 29.........	959.5	7.73	925.8	7.51	1,885.3	7.62	1,074.8	7.78	1,035.8	7.54	2,110.6	7.66
30 – 34.........	746.2	6.01	726.2	5.89	1,472.4	5.95	963.3	6.97	931.6	6.78	1,894.9	6.88
35 – 39.........	602.8	4.85	616.0	5.00	1,218.8	4.93	747.4	5.41	729.3	5.31	1,476.7	5.36
40 – 44.........	618.0	4.98	604.4	4.90	1,222.4	4.94	600.9	4.34	615.7	4.48	1,216.6	4.42
45 – 49.........	635.3	5.11	625.8	5.08	1,261.1	5.10	611.6	4.42	601.6	4.38	1,213.2	4.40
50 – 54.........	605.1	4.87	626.7	5.09	1,231.8	4.98	619.9	4.49	618.3	4.50	1,238.2	4.49
55 – 59.........	516.4	4.16	536.6	4.35	1,053.0	4.25	579.4	4.19	613.6	4.47	1,193.0	4.33
60 – 64.........	445.7	3.59	466.0	3.78	911.7	3.68	479.0	3.47	519.1	3.78	998.1	3.62
65 – 69.........	348.0	2.80	373.2	3.03	721.2	2.91	394.8	2.86	439.1	3.20	833.9	3.02
70 – 74.........	248.7	2.00	282.9	2.30	531.6	2.15	291.1	2.11	340.1	2.48	631.2	2.29
75 + ...	334.8	2.70	459.3	3.73	794.1	3.21	374.1	2.71	527.0	3.84	901.1	3.27
Total......	12,421.3	100.00	12,322.2	100.00	24,743.5	100.00	13,818.4	100.00	13,734.2	100.00	27,552.6	100.00

TABLE 9 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 25,000 per annum)

Age Group	June 1, 1986						June 1, 1991					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,964.7	12.80	1,866.5	12.22	3,831.2	12.51	2,132.3	12.54	2,024.3	11.95	4,156.6	12.24
5 – 9	1,784.4	11.62	1,699.0	11.12	3,483.4	11.37	1,962.3	11.54	1,866.9	11.02	3,829.2	11.28
10 – 14........	1,566.1	10.20	1,493.8	9.78	3,059.9	9.99	1,785.1	10.49	1,701.4	10.05	3,486.5	10.27
15 – 19........	1,356.7	8.84	1,296.8	8.49	2,653.5	8.66	1,567.3	9.21	1,496.4	8.84	3,063.7	9.02
20 – 24........	1,221.5	7.96	1,172.2	7.67	2,393.7	7.82	1,360.3	8.00	1,303.9	7.70	2,664.2	7.85
25 – 29........	1,162.3	7.57	1,122.5	7.35	2,284.8	7.46	1,227.8	7.22	1,181.5	6.98	2,409.3	7.10
30 – 34........	1,078.3	7.02	1,041.5	6.82	2,119.8	6.92	1,165.9	6.85	1,128.2	6.66	2,294.1	6.76
35 – 39........	963.5	6.28	934.3	6.12	1,897.8	6.20	1,078.3	6.34	1,044.2	6.16	2,122.5	6.25
40 – 44........	744.6	4.85	728.5	4.77	1,473.1	4.81	959.3	5.64	932.7	5.51	1,892.0	5.57
45 – 49........	595.2	3.88	613.1	4.01	1,208.3	3.94	737.5	4.34	725.5	4.28	1,463.0	4.31
50 – 54........	597.3	3.89	594.8	3.89	1,192.1	3.89	581.6	3.42	606.6	3.58	1,188.2	3.50
55 – 59........	593.9	3.87	605.9	3.96	1,199.8	3.92	572.6	3.37	583.4	3.44	1,156.0	3.41
60 – 64........	537.6	3.50	594.4	3.89	1,132.0	3.70	551.3	3.24	587.8	3.47	1,139.1	3.36
65 – 69........	424.4	2.76	489.7	3.20	914.1	2.98	476.3	2.80	561.5	3.32	1,037.8	3.06
70 – 74........	330.5	2.15	401.6	2.63	732.1	2.39	355.4	2.09	449.6	2.65	805.0	2.37
75 + ...	431.2	2.81	623.6	4.08	1,054.8	3.44	495.3	2.91	743.8	4.39	1,239.1	3.65
Total	15,352.2	100.00	15,278.2	100.00	30,630.4	100.00	17,008.6	100.00	16,937.7	100.00	33,946.3	100.00

TABLE 10

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 25,000 per annum)

Population Groups	Age Group	June 1, 1966						June 1, 1971					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0 – 4	1,218.4	11.99	1,160.3	11.60	2,378.7	11.80	1,358.3	12.12	1,291.7	11.66	2,650.0	11.89
Elementary school	5 – 14	2,215.4	21.81	2,120.0	21.20	4,335.4	21.51	2,367.7	21.13	2,264.8	20.44	4,632.5	20.79
High school	15 – 19	949.1	9.34	910.0	9.10	1,859.1	9.22	1,064.9	9.50	1,020.0	9.20	2,084.9	9.36
University	20 – 24	733.9	7.23	710.4	7.11	1,444.3	7.16	953.0	8.51	916.6	8.27	1,869.6	8.39
Labour Force Recruiting	15 – 24	1,683.0	16.57	1,620.4	16.20	3,303.4	16.39	2,017.9	18.01	1,936.6	17.48	3,954.5	17.74
Labour Force	15 – 64	5,985.7	58.92	5,888.3	58.88	11,874.0	58.90	6,656.5	59.40	6,565.5	59.25	13,222.0	59.33
Elderly	65 +	739.6	7.28	831.3	8.31	1,570.9	7.79	823.0	7.34	959.2	8.66	1,782.2	8.00
Dependent	0 – 14, 65+	4,173.4	41.08	4,111.6	41.12	8,285.0	41.10	4,549.0	40.60	4,515.7	40.75	9,064.7	40.67
Main Family Formation Ages	20 – 29	1,329.4	13.09	1,316.7	13.17	2,646.1	13.13	1,694.5	15.12	1,636.6	14.77	3,331.1	14.95

TABLE 10 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 25,000 per annum)

Population Groups	Age Group	June 1, 1976						June 1, 1981					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0 – 4	1,568.0	12.62	1,491.3	12.10	3,059.3	12.36	1,787.0	12.93	1,698.7	12.37	3,485.7	12.65
Elementary school	5 – 14	2,571.6	20.70	2,454.9	19.92	5,026.5	20.31	2,921.2	21.14	2,785.8	20.28	5,707.0	20.71
High school	15 – 19	1,152.6	9.28	1,106.5	8.98	2,259.1	9.13	1,217.7	8.81	1,165.2	8.48	2,382.9	8.65
University	20 – 24	1,068.6	8.60	1,026.6	8.33	2,095.2	8.47	1,156.2	8.37	1,113.3	8.11	2,269.5	8.24
Labour Force Recruiting	15 – 24	2,221.2	17.88	2,133.1	17.31	4,354.3	17.60	2,373.9	17.18	2,278.5	16.59	4,652.4	16.89
Labour Force	15 – 64	7,350.2	59.17	7,260.6	58.92	14,610.8	59.05	8,050.2	58.26	7,943.5	57.84	15,993.7	58.05
Elderly	65 +	931.5	7.50	1,115.4	9.05	2,046.9	8.27	1,060.0	7.67	1,306.2	9.51	2,366.2	8.59
Dependent	0 – 14, 65 +	5,071.1	40.83	5,061.6	41.08	10,132.7	40.95	5,768.2	41.74	5,790.7	42.16	11,558.9	41.95
Main Family Formation Ages	20 – 29	2,028.1	16.33	1,952.4	15.84	3,980.5	16.09	2,231.0	16.15	2,149.1	15.65	4,380.1	15.90

TABLE 10 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 25,000 per annum)

Population Groups	Age Group	June 1, 1986						June 1, 1991					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0 – 4	1,964.7	12.80	1,866.5	12.22	3,831.2	12.51	2,132.3	12.54	2,024.3	11.95	4,156.6	12.24
Elementary school	5 – 14	3,350.5	21.82	3,192.8	20.90	6,543.3	21.36	3,747.4	22.03	3,568.3	21.07	7,315.7	21.55
High school	15 – 19	1,356.7	8.84	1,296.8	8.49	2,653.5	8.66	1,567.3	9.21	1,496.4	8.84	3,063.7	9.02
University	20 – 24	1,221.5	7.96	1,172.2	7.67	2,393.7	7.82	1,360.3	8.00	1,303.9	7.70	2,664.2	7.85
Labour Force Recruiting...........	15 – 24	2,578.2	16.79	2,469.0	16.16	5,047.2	16.48	2,927.6	17.21	2,800.3	16.53	5,727.9	16.87
Labour Force	15 – 64	8,850.9	57.65	8,704.0	56.97	17,554.9	57.31	9,801.9	57.63	9,590.2	56.62	19,392.1	57.13
Elderly	65+	1,186.1	7.73	1,514.9	9.92	2,701.0	8.82	1,327.0	7.80	1,754.9	10.36	3,081.9	9.08
Dependent	0 – 14, 65+	6,501.3	42.35	6,574.2	43.03	13,075.5	42.69	7,206.7	42.37	7,347.5	43.38	14,554.2	42.87
Main Family Formation Ages	20 – 29	2,383.8	15.53	2,294.7	15.02	4,678.5	15.27	2,588.1	15.22	2,485.4	14.67	5,073.5	14.95

TABLE 11

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 50,000 per annum)

Age Group	June 1, 1966						June 1, 1971					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 — 4	1,227.7	12.00	1,169.2	11.62	2,396.9	11.81	1,382.8	12.17	1,315.0	11.72	2,697.8	11.94
5 — 9	1,157.2	11.31	1,107.6	11.00	2,264.8	11.16	1,231.2	10.84	1,174.9	10.46	2,406.1	10.65
10 — 14	1,068.4	10.44	1,022.0	10.15	2,090.4	10.30	1,161.8	10.23	1.113.9	9.92	2,275.7	10.07
15 — 19..........	952.8	9.31	913.4	9.07	1,866.2	9.20	1,072.9	9.45	1,027.6	9.15	2,100.5	9.30
20 — 24	743.0	7.26	718.8	7.14	1,461.8	7.20	965.8	8.50	928.4	8.27	1,894.2	8.39
25 — 29	608.1	5.95	617.8	6.14	1,225.9	6.04	763.2	6.72	739.9	6.59	1,503.1	6.65
30 — 34	628.4	6.14	610.3	6.06	1,238.7	6.10	622.9	5.48	632.8	5.64	1,255.7	5.56
35 — 39	651.5	6.37	635.5	6.31	1,287.0	6.34	635.9	5.60	618.7	5.51	1,254.6	5.55
40 — 44	631.4	6.17	641.9	6.38	1,273.3	6.27	652.0	5.74	637.8	5.68	1,289.8	5.71
45 — 49	555.7	5.43	557.7	5.54	1,113.4	5.49	626.3	5.51	640.2	5.70	1,266.5	5.61
50 — 54	503.9	4.94	495.0	4.92	998.9	4.92	543.2	4.78	552.3	4.92	1,095.5	4.85
55 — 59	424.6	4.15	412.3	4.10	836.9	4.12	483.1	4.25	485.5	4.32	968.6	4.29
60 — 64	336.3	3.29	332.4	3.30	668.7	3.30	394.2	3.47	398.9	3.55	793.1	3.51
65 — 69	259.7	2.54	274.1	2.72	533.8	2.63	298.5	2.63	313.3	2.79	611.8	2.71
70 — 74	200.5	1.96	223.6	2.22	424.1	2.09	217.4	1.91	248.5	2.21	465.9	2.06
75+	280.3	2.74	335.4	3.33	615.7	3.03	309.2	2.72	401.4	3.57	710.6	3.15
Total	10,229.5	100.00	10,067.0	100.00	20,296.5	100.00	11,360.4	100.00	11,229.1	100.00	22,589.5	100.00

TABLE 11 (Cont'd)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 50,000 per annum)

Age Group	June 1, 1976						June 1, 1981					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0–4	1,604.7	12.66	1,526.2	12.15	3,130.9	12.41	1,833.8	12.94	1,743.2	12.39	3,577.0	12.66
5–9	1,385.2	10.93	1,320.7	10.51	2,705.9	10.72	1,607.9	11.34	1,531.8	10.88	3,139.7	11.12
10–14	1,236.1	9.76	1,181.3	9.40	2,417.4	9.58	1,390.1	9.81	1,327.2	9.43	2,717.3	9.62
15–19	1,166.4	9.20	1,119.6	8.91	2,286.0	9.06	1,240.7	8.75	1,187.1	8.43	2,427.8	8.60
20–24	1,085.7	8.57	1,042.6	8.30	2,128.3	8.43	1,179.1	8.32	1,134.7	8.06	2,313.8	8.19
25–29	984.8	7.77	949.1	7.56	1,933.9	7.66	1,104.4	7.79	1,063.3	7.56	2,167.7	7.67
30–34	777.2	6.13	754.7	6.01	1,531.9	6.07	997.9	7.04	963.4	6.85	1,961.3	6.94
35–39	630.7	4.98	641.3	5.11	1,272.0	5.04	784.3	5.54	762.9	5.42	1,547.2	5.48
40–44	636.9	5.03	621.4	4.95	1,258.3	4.99	632.1	4.46	644.1	4.58	1,276.2	4.52
45–49	647.0	5.11	636.5	5.07	1,283.5	5.09	632.6	4.46	620.6	4.41	1,253.2	4.44
50–54	612.3	4.83	633.9	5.05	1,246.2	4.94	632.9	4.47	630.7	4.48	1,263.6	4.47
55–59	520.9	4.11	541.8	4.31	1,062.7	4.21	587.2	4.14	622.0	4.42	1,209.2	4.28
60–64	448.6	3.54	470.1	3.74	918.7	3.64	483.8	3.41	525.2	3.73	1,009.0	3.57
65–69	349.7	2.76	376.2	2.99	725.9	2.88	397.9	2.81	443.7	3.15	841.6	2.98
70–74	249.9	1.97	285.0	2.27	534.9	2.12	292.9	2.07	343.4	2.44	636.3	2.25
75+	335.7	2.65	461.3	3.67	797.0	3.16	375.5	2.65	530.3	3.77	905.8	3.21
Total	12,671.8	100.00	12,561.7	100.00	25,233.5	100.00	14,173.1	100.00	14,073.6	100.00	28,246.7	100.00

TABLE 11 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 50,000 per annum)

Age Group	June 1, 1986						June 1, 1991					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0–4	2,022.1	12.78	1,921.0	12.21	3,943.1	12.50	2,204.0	12.52	2,092.4	11.95	4,296.4	12.24
5–9	1,836.9	11.61	1,748.9	11.12	3,585.8	11.37	2,025.4	11.51	1,926.9	11.01	3,952.3	11.26
10–14	1,612.8	10.19	1,538.2	9.78	3,151.0	9.99	1,841.9	10.46	1,755.4	10.03	3,597.3	10.25
15–19	1,394.8	8.82	1,333.0	8.48	2,727.8	8.65	1,617.5	9.19	1,544.2	8.82	3,161.7	9.00
20–24	1,253.5	7.92	1,202.4	7.64	2,455.9	7.79	1,407.4	8.00	1,348.5	7.70	2,755.9	7.85
25–29	1,197.7	7.57	1,155.4	7.35	2,353.1	7.46	1,272.3	7.23	1,223.2	6.99	2,495.5	7.11
30–34	1,117.2	7.06	1,077.4	6.85	2,194.6	6.96	1,210.6	6.88	1,169.5	6.68	2,380.1	6.78
35–39	1,004.0	6.35	971.3	6.18	1,975.3	6.26	1,123.1	6.38	1,085.3	6.20	2,208.4	6.29
49–44	784.7	4.96	765.3	4.87	1,550.0	4.91	1,003.1	5.70	972.9	5.56	1,976.0	5.63
45–49	628.3	3.97	643.5	4.09	1,271.8	4.03	779.4	4.43	764.2	4.37	1,543.6	4.40
50–54	619.2	3.92	615.4	3.91	1,234.6	3.91	615.4	3.50	638.4	3.65	1,253.8	3.57
55–59	607.3	3.84	619.4	3.94	1,226.7	3.89	594.5	3.38	605.0	3.45	1,199.5	3.42
60–64	545.5	3.45	603.6	3.84	1,149.1	3.64	564.3	3.20	601.9	3.44	1,166.2	3.32
65–69	429.1	2.71	496.3	3.16	925.4	2.93	483.7	2.75	570.9	3.26	1,054.6	3.00
70–74	333.3	2.11	406.4	2.58	739.7	2.34	359.6	2.04	456.2	2.60	815.8	2.32
75+	433.4	2.74	628.6	4.00	1,062.0	3.37	498.6	2.83	751.0	4.29	1,249.6	3.56
Total	15,819.8	100.00	15,726.1	100.00	31,545.9	100.00	17,600.8	100.00	17,505.9	100.00	35,106.7	100.00

TABLE 12

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 50,000 per annum)

Population Groups	Age Group	June 1, 1966						June 1, 1971					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school............	0 – 4	1,227.7	12.00	1,169.2	11.62	2,396.9	11.81	1,382.8	12.17	1,315.0	11.72	2,697.8	11.94
Elementary school......	5 – 14	2,225.6	21.76	2,129.6	21.15	4,355.2	21.46	2,393.0	21.06	2,288.8	20.38	4,681.8	20.73
High school............	15 – 19	952.8	9.31	913.4	9.07	1,866.2	9.20	1,072.9	9.45	1,027.6	9.15	2,100.5	9.30
University	20 – 24	743.0	7.26	718.8	7.14	1,461.8	7.20	965.8	8.50	928.4	8.27	1,894.2	8.39
Labour Force Recruiting..........	15 – 24	1,695.8	16.58	1,632.2	16.21	3,328.0	16.40	2,038.7	17.95	1,956.0	17.42	3,994.7	17.63
Labour Force	15 – 64	6,035.7	59.00	5,935.1	58.96	11,970.8	58.98	6,759.5	59.50	6,662.1	59.33	13,421.6	59.42
Elderly................	65+	740.5	7.24	833.1	8.28	1,573.6	7.75	825.1	7.26	963.2	8.58	1,788.3	7.92
Dependent............	0 – 14, 65+	4,193.8	41.00	4,131.9	41.04	8,325.7	41.02	4,600.9	40.50	4,567.0	40.67	9,167.9	40.58
Main Family Formation Ages	20 – 29	1,351.1	13.21	1,336.6	13.28	2,687.7	13.24	1,729.0	15.22	1,668.3	14.86	3,397.3	15.04

TABLE 12 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons),
SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 50,000 per annum)

Population Groups	Age Group	June 1, 1976						June 1, 1981					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school.............	0 – 4	1,604.7	12.66	1,526.2	12.15	3,130.9	12.41	1,833.8	12.94	1,743.2	12.39	3,577.0	12.66
Elementary school......	5 – 14	2,621.3	20.69	2,502.0	19.92	5,123.3	20.30	2,998.0	21.15	2,859.0	20.31	5,857.0	20.74
High school............	15 – 19	1,166.4	9.20	1,119.6	8.91	2,286.0	9.06	1,240.7	8.75	1,187.1	8.43	2,427.8	8.60
University.............	20 – 24	1,085.7	8.57	1,042.6	8.30	2,128.3	8.43	1,179.1	8.32	1,134.7	8.06	2,313.8	8.19
Labour Force Recruiting...........	15 – 24	2,252.1	17.77	2,162.2	17.21	4,414.3	17.49	2,419.8	17.07	2,321.8	16.50	4,741.6	16.79
Labour Force	15 – 64	7,510.5	59.27	7,411.0	59.00	14,921.5	59.13	8,275.0	58.39	8,154.0	57.94	16,429.0	58.16
Elderly................	65+	935.3	7.38	1,122.5	8.94	2,057.8	8.16	1,066.3	7.52	1,317.4	9.36	2,383.7	8.44
Dependent..............	0 – 14, 65+	5,161.3	40.73	5,150.7	41.00	10,312.0	40.87	5,898.1	41.61	5,919.6	42.06	11,817.7	41.84
Main Family Formation Ages	20 – 29	2,070.5	16.34	1,991.7	15.86	4,062.2	16.10	2,283.5	16.11	2,198.0	15.62	4,481.5	15.87

TABLE 12 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons),
SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 50,000 per annum)

Population Groups	Age Group	June 1, 1986						June 1, 1991					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0 – 4	2,022.1	12.78	1,921.0	12.21	3,943.1	12.50	2,204.0	12.52	2,092.4	11.95	4,296.4	12.24
Elementary school	5 – 14	3,449.7	21.81	3,287.1	20.90	6,736.8	21.36	3,867.3	21.97	3,682.3	21.03	7,549.6	21.50
High school	15 – 19	1,394.8	8.82	1,333.0	8.48	2,727.8	8.65	1,617.5	9.19	1,544.2	8.82	3,161.7	9.00
University	20 – 24	1,253.5	7.92	1,202.4	7.64	2,455.9	7.79	1,407.4	8.00	1,348.5	7.70	2,755.9	7.85
Labour Force Recruiting	15 – 24	2,648.3	16.74	2,535.4	16.12	5,183.7	16.43	3,024.9	17.19	2,892.7	16.52	5,917.6	16.86
Labour Force	15 – 64	9,152.2	57.85	8,986.7	57.15	18,138.9	57.50	10,187.6	57.88	9,953.1	56.86	20,140.7	57.37
Elderly	65+	1,195.8	7.56	1,531.3	9.74	2,727.1	8.64	1,341.9	7.62	1,778.1	10.16	3,120.0	8.89
Dependent	0 – 14, 65+	6,667.6	42.15	6,739.4	42.85	13,407.0	42.50	7,413.2	42.12	7,552.8	43.14	14,966.0	42.63
Main Family Formation Ages	20 – 29	2,451.2	15.49	2,357.8	14.99	4,809.0	15.24	2,679.7	15.22	2,571.7	14.69	5,251.4	14.96

TABLE 13

PROJECTED POPULATION OF CANADA (Thousands of Persons)

(Net Immigration — 100,000 per annum)

Age Group	June 1, 1966						June 1, 1971					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,246.3	12.02	1,186.8	11.63	2,433.1	11.83	1,431.8	12.27	1,361.6	11.81	2,793.4	12.04
5 – 9	1,168.9	11.27	1,118.7	10.98	2,287.6	11.12	1,261.4	10.81	1,203.5	10.44	2,464.9	10.63
10 – 14	1,077.2	10.39	1,030.3	10.10	2,107.5	10.24	1,182.2	10.13	1,133.2	9.83	2,315.4	9.98
15 – 19	960.0	9.26	920.2	9.02	1,880.2	9.14	1,088.9	9.33	1,042.6	9.05	2,131.5	9.19
20 – 24	761.3	7.34	735.7	7.21	1,497.0	7.28	991.3	8.49	952.1	8.26	1,943.4	8.38
25 – 29	633.3	6.11	640.9	6.28	1,274.2	6.19	806.5	6.91	779.8	6.77	1,586.3	6.84
30 – 34	647.3	6.24	627.3	6.15	1,274.6	6.20	666.9	5.71	672.8	5.84	1,339.7	5.78
35 – 39	663.6	6.40	646.2	6.33	1,309.8	6.37	666.8	5.71	646.4	5.61	1,313.2	5.66
40 – 44	638.5	6.16	648.5	6.36	1,287.0	6.26	671.1	5.75	655.0	5.68	1,326.1	5.72
45 – 49	560.2	5.40	562.1	5.51	1,122.3	5.46	637.9	5.48	651.1	5.65	1,289.0	5.56
50 – 54	507.1	4.89	498.5	4.89	1,005.6	4.89	550.8	4.72	560.2	4.86	1,111.0	4.79
55 – 59	426.5	4.10	415.1	4.07	841.6	4.09	487.9	4.18	491.8	4.27	979.7	4.22
60 – 64	337.6	3.26	334.5	3.28	672.1	3.27	397.3	3.40	403.8	3.50	801.1	3.45
65 – 69	260.6	2.51	275.6	2.70	536.2	2.60	300.5	2.58	316.8	2.75	617.3	2.66
70 – 74	201.1	1.94	224.7	2.20	425.8	2.07	218.7	1.87	251.0	2.18	469.7	2.02
75+	280.6	2.71	336.1	3.29	616.7	2.99	310.2	2.66	403.4	3.50	713.6	3.08
Total	10,370.1	100.00	10,201.2	100.00	20,571.3	100.00	11,670.2	100.00	11,525.1	100.00	23,195.3	100.00

TABLE 13 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration – 100,000 per annum)

Age Group	June 1, 1976						June 1, 1981					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	1,678.1	12.74	1,595.9	12.24	3,274.0	12.49	1,927.6	12.95	1,832.3	12.42	3,759.9	12.69
5 – 9	1,445.6	10.98	1,378.2	10.57	2,823.8	10.77	1,692.7	11.37	1,612.4	10.93	3,305.1	11.15
10 – 14	1,274.9	9.68	1,218.1	9.34	2,493.0	9.51	1,459.1	9.80	1,392.8	9.44	2,851.9	9.62
15 – 19	1,194.0	9.06	1,145.7	8.79	2,339.7	8.93	1,286.8	8.65	1,230.7	8.34	2,517.5	8.49
20 – 24	1,119.9	8.50	1,074.6	8.24	2,194.5	8.37	1,224.9	8.23	1,177.7	7.98	2,402.6	8.11
25 – 29	1,035.4	7.86	995.8	7.64	2,031.2	7.75	1,163.6	7.82	1,118.2	7.58	2,281.8	7.70
30 – 34	839.3	6.37	811.4	6.22	1,650.7	6.30	1,067.1	7.17	1,027.0	6.96	2,094.1	7.07
35 – 39	686.5	5.22	691.8	5.30	1,378.3	5.26	858.0	5.77	830.2	5.63	1,688.2	5.70
40 – 44	674.6	5.12	655.4	5.03	1,330.0	5.07	694.6	4.67	700.9	4.75	1,395.5	4.71
45 – 49	670.4	5.09	658.0	5.05	1,328.4	5.07	674.4	4.53	658.7	4.47	1,333.1	4.50
50 – 54	626.8	4.76	648.2	4.96	1,275.0	4.86	658.8	4.43	655.4	4.44	1,314.2	4.43
55 – 59	530.0	4.02	552.3	4.24	1,082.3	4.13	602.9	4.05	638.8	4.33	1,241.7	4.19
60 – 64	454.4	3.45	478.3	3.67	932.7	3.56	493.5	3.32	537.5	3.64	1,031.0	3.48
65 – 69	353.3	2.68	382.3	2.93	735.6	2.80	403.8	2.71	453.0	3.08	856.8	2.89
70 – 74	252.1	1.91	289.3	2.22	541.4	2.07	296.4	1.99	350.0	2.37	646.4	2.18
75 + ...	337.4	2.56	465.2	3.56	802.6	3.06	378.4	2.54	536.8	3.64	915.2	3.09
Total	13,172.7	100.00	13,040.5	100.00	26,213.2	100.00	14,882.6	100.00	14,752.4	100.00	29,635.0	100.00

TABLE 13 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons)
(Net Immigration — 100,000 per annum)

Age Group	June 1, 1986						June 1, 1991					
	Males		Females		Total		Males		Females		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0 – 4	2,137.0	12.75	2,030.1	12.21	4,167.1	12.48	2,347.5	12.50	2,228.5	11.95	4,576.0	12.23
5 – 9	1,942.0	11.59	1,848.8	11.12	3,790.8	11.36	2,151.5	11.45	2,046.7	10.98	4,198.2	11.21
10 – 14	1,706.0	10.18	1,627.0	9.79	3,333.0	9.99	1,955.5	10.41	1,863.5	10.00	3,819.0	10.20
15 – 19	1,471.0	8.78	1,405.4	8.46	2,876.4	8.62	1,717.9	9.14	1,639.7	8.80	3,357.6	8.97
20 – 24	1,317.6	7.86	1,262.9	7.60	2,580.5	7.73	1,501.5	7.99	1,437.8	7.70	2,939.3	7.85
25 – 29	1,268.5	7.58	1,221.3	7.35	2,489.8	7.46	1,361.3	7.25	1,306.6	7.01	2,667.9	7.13
30 – 34	1,195.1	7.13	1,149.2	6.91	2,344.3	7.02	1,299.9	6.92	1,252.3	6.72	2,552.2	6.82
35 – 39	1,084.8	6.47	1,045.4	6.29	2,130.2	6.38	1,212.6	6.46	1,167.6	6.26	2,380.2	6.36
40 – 44	865.0	5.16	838.8	5.05	1,703.8	5.11	1,090.5	5.80	1,053.1	5.65	2,143.6	5.73
45 – 49	694.5	4.15	704.2	4.24	1,398.7	4.19	863.2	4.60	841.6	4.51	1,704.8	4.55
50 – 54	663.1	3.96	656.6	3.95	1,319.7	3.95	683.0	3.64	701.9	3.77	1,384.9	3.70
55 – 59	633.9	3.78	646.4	3.89	1,280.3	3.84	638.4	3.40	648.1	3.48	1,286.5	3.44
60 – 64	561.3	3.35	621.9	3.74	1,183.2	3.54	590.3	3.14	630.2	3.38	1,220.5	3.26
65 – 69	438.5	2.62	509.4	3.06	947.9	2.84	498.6	2.65	589.8	3.16	1,088.4	2.91
70 – 74	338.9	2.02	415.9	2.50	754.8	2.26	368.2	1.96	469.3	2.52	837.5	2.24
75 + ...	437.9	2.62	638.6	3.84	1,076.5	3.23	505.4	2.69	765.5	4.11	1,270.9	3.40
Total	16,755.1	100.00	16,621.9	100.00	33,377.0	100.00	18,785.3	100.00	18,642.2	100.00	37,427.5	100.00

TABLE 14

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 100,000 per annum)

Population Groups	Age Group	June 1, 1966						June 1, 1971					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0 – 4	1,246.3	12.02	1,186.8	11.63	2,433.1	11.83	1,431.8	12.27	1,361.6	11.81	2,793.4	12.04
Elementary school	5 – 14	2,246.1	21.66	2,149.0	21.07	4,395.1	21.37	2,443.6	20.94	2,336.7	20.27	4,780.3	20.61
High school	15 – 19	960.0	9.26	920.2	9.02	1,880.2	9.14	1,088.9	9.33	1,042.6	9.05	2,131.5	9.19
University	20 – 24	761.3	7.34	735.7	7.21	1,497.0	7.28	991.3	8.49	952.1	8.26	1,943.4	8.38
Labour Force Recruiting	15 – 24	1,721.3	16.60	1,655.9	16.23	3,377.2	16.42	2,080.2	17.82	1,994.7	17.31	4,074.9	17.57
Labour Force	15 – 64	6,135.4	59.16	6,029.0	59.10	12,164.4	59.13	6,965.4	59.69	6,855.6	59.48	13,821.0	59.59
Elderly	65+	742.3	7.16	836.4	8.20	1,578.7	7.67	829.4	7.11	971.2	8.43	1,800.6	7.76
Dependent	0 – 14, 65+	4,234.7	40.84	4,172.2	40.90	8,406.9	40.87	4,704.8	40.31	4,669.5	40.52	9,374.3	40.41
Main Family Formation Ages	20 – 29	1,394.6	13.45	1,376.6	13.49	2,771.2	13.47	1,797.8	15.40	1,731.9	15.03	3,529.7	15.22

TABLE 14 (Cont'd.)

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 100,000 per annum)

Population Groups	Age Group	June 1, 1976						June 1, 1981					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0 – 4	1,678.1	12.74	1,595.9	12.24	3,274.0	12.49	1,927.6	12.95	1,832.3	12.42	3,759.9	12.69
Elementary school	5 – 14	2,720.5	20.65	2,596.3	19.91	5,316.8	20.28	3,151.8	21.18	3,005.2	20.37	6,157.0	20.78
High school	15 – 19	1,194.0	9.06	1,145.7	8.79	2,339.7	8.93	1,286.8	8.65	1,230.7	8.34	2,517.5	8.49
University	20 – 24	1,119.9	8.50	1,074.6	8.24	2,194.5	8.37	1,224.9	8.23	1,177.7	7.98	2,402.6	8.11
Labour Force Recruiting	15 – 24	2,313.9	17.57	2,220.3	17.03	4,534.2	17.30	2,511.7	16.88	2,408.4	16.33	4,920.1	16.60
Labour Force	15 – 64	7,831.3	59.45	7,711.5	59.14	15,542.8	59.29	8,724.6	58.62	8,575.1	58.13	17,299.7	58.38
Elderly	65+	942.8	7.16	1,136.8	8.72	2,079.6	7.93	1,078.6	7.25	1,339.8	9.08	2,418.4	8.16
Dependent	0 – 14, 65+	5,341.4	40.55	5,329.0	40.86	10,670.4	40.71	6,158.0	41.38	6,177.3	41.87	12,335.3	41.62
Main Family Formation Ages	20 – 29	2,155.3	16.36	2,070.4	15.88	4,225.7	16.12	2,388.5	16.05	2,295.9	15.56	4,684.4	15.81

TABLE 14 (Concl.)

PROJECTED POPULATION OF CANADA (Thousands of Persons), SELECTED AGE GROUPS, 1966–1991 (Net Immigration – 100,000 per annum)

Population Groups	Age Group	June 1, 1986						June 1, 1991					
		Males		Females		Total		Males		Females		Total	
		No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Pre-school	0–4	2,137.0	12.75	2,030.1	12.21	4,167.1	12.48	2,347.5	12.50	2,228.5	11.95	4,576.0	12.23
Elementary school	5–14	3,648.0	21.77	3,475.8	20.91	7,123.8	21.34	4,107.0	21.86	3,910.2	20.97	8,017.2	21.42
High school	15–19	1,471.0	8.78	1,405.4	8.46	2,876.4	8.62	1,717.9	9.14	1,639.7	8.80	3,357.6	8.97
University	20–24	1,317.6	7.86	1,262.9	7.60	2,580.5	7.73	1,501.5	7.99	1,437.8	7.70	2,939.3	7.85
Labour Force Recruiting	15–24	2,788.6	16.64	2,668.3	16.05	5,456.9	16.35	3,219.4	17.14	3,077.5	16.51	6,296.9	16.82
Labour Force	15–64	9,754,8	58.22	9,552.1	57.47	19,306.9	57.84	10,958.6	58.34	10,678.9	57.28	21,637.5	57.81
Elderly	65+	1,215.3	7.25	1,563.9	9.41	2,779.2	8.33	1,372.2	7.30	1,824.6	9.79	3,196.8	8.54
Dependent	0–14, 65+	7,000.3	41.78	7,069.8	42.53	14,070.1	42.16	7,826.7	41.66	7,963.3	42.72	15,790.0	42.19
Main Family Formation Ages	20–29	2,586.1	15.43	2,484.2	14.95	5,070.3	15.19	2,862.8	15.24	2,744.4	14.72	5,607.2	14.98

TABLE 15

POPULATION BY PROVINCE, INTERCENSAL ABSOLUTE NATURAL GROWTH (= birth – deaths) AND NET MIGRATION

Census Year	Data	New-foundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario
1921	Census population	263,033	88,615	523,837	387,876	2,360,510	2,933,662
	Intercensal natural growth	31,965	8,230	51,265	56,475	499,095	346,280
	Intercensal net migration	– 13,498	– 8,807	– 62,256	– 36,132	15,057	151,741
1931	Census population	281,500	88,038	512,846	408,219	2,874,662	3,431,683
	Intercensal natural growth	35,006	9,671	56,740	58,975	456,900	279,427
	Intercensal net migration	– 13,206	– 2,662	8,376	– 9,793	320	76,545
1941	Census population	303,300	95,047	577,962	457,401	3,331,882	3,787,655
	Intercensal natural growth	73,915	15,815	103,859	99,896	727,029	504,738
	Intercensal net migration	– 15,799	– 12,433	– 39,237	– 41,600	– 3,230	305,149
1951	Census population	361,416	98,429	642,584	515,697	4,055,681	4,597,542
	Intercensal natural growth	50,874	8,986	62,220	59,604	471,271	420,730
	Intercensal net migration	2,784	– 8,130	– 10,087	– 20,685	101,426	386,661
1956	Census population	415,074	99,285	694,717	554,616	4,628,378	5,404,933
	Intercensal natural growth	59,098	8,602	65,176	59,636	520,651	516,286
	Intercensal net migration	– 16,319	– 3,258	– 22,886	– 16,316	110,182	314,873
1961	Census population	457,853	104,629	737,007	597,936	5,259,211	6,236,092

TABLE 15 (Concl.)

POPULATION BY PROVINCE, INTERCENSAL ABSOLUTE NATURAL GROWTH (= births − deaths) AND NET MIGRATION

Census Year	Data	Manitoba	Saskat-chewan	Alberta	British Columbia	Yukon & Northwest Territories	Canada
1921	Census population	610,118	757,510	588,454	524,582	12,300	9,050,497
	Intercensal natural growth	20,127	30,763	20,901	9,813	− 47	280,219
	Intercensal net migration	69,894	133,512	122,250	159,868	1,293	1,327,570
1931	Census population	700,139	921,785	731,605	694,263	13,546	10,658,286
	Intercensal natural growth	78,281	132,987	106,687	40,349	437	1,255,460
	Intercensal net migration	−48,676	−158,780	−42,123	83,249	2,959	103,791
1941	Census population	729,744	895,992	796,169	817,861	16,942	11,809,955
	Intercensal natural growth	109,106	137,206	149,832	116,019	2,382	2,039,797
	Intercensal net migration	−62,309	−201,470	− 6,500	231,330	5,776	159,677
1951	Census population	776,541	831,728	939,501	1,165,210	25,100	14,009,429
	Intercensal natural growth	72,732	85,032	117,800	95,568	3,523	1,448,340
	Intercensal net migration	767	− 36,095	65,815	137,686	2,880	623,022
1956	Census population	850,040	880,665	1,123,116	1,398,464	31,503	16,080,791
	Intercensal natural growth	75,579	86,467	142,953	124,750	5,231	1,664,429
	Intercensal net migration	− 3,933	41,951	65,875	105,868	892	493,027
1961	Census population	921,686	925,181	1,331,944	1,629,082	37,626	18,238,247

TABLE 16

POPULATION PROJECTIONS[1], CANADA, ROYAL COMMISSION ON CANADA'S ECONOMIC PROSPECTS, 1960 TO 1980, AND ROYAL COMMISSION ON HEALTH SERVICES, 1961 TO 1991.
(Thousands of Persons)

Year	Royal Commission on Canada's Economic Prospects			Royal Commission on Health Services		
	Male	Female	Total	Male	Female	Total
1960	8,780.3	8,586.3	17,366.6			
1961				9,218.9	9,019.4	18,238.2
1965	9,703.1	9,510.9	19,215.0			
1966				10,229.5	10,067.0	20,296.5
1970	10,676.3	10,482.5	21,158.8			
1971				11,360.4	11,229.1	22,589.5
1975	11,758.1	11,556.1	23,314.2			
1976				12,671.8	12,561.7	25,233.5
1980	12,981.5	12,791.6	25,773.1			
1981				14,173.1	14,073.6	28,246.7
1986	–	–	–	15,819.8	15,726.1	31,545.9
1991	–	–	–	17,600.8	17,505.9	35,106.7
	Increase Over Period – Per cent					
1960–80	47.8	49.0	48.4			
1961–81				53.7	56.0	54.9
	Annual Average Increase – Per cent					
1960–80	2.0	2.0	2.0			
1961–81				2.2	2.2	2.2

[1] Assuming annual net immigration of 50,000.

Source: Royal Commission on Canada's Economic Prospects, *Output, Labour and Capital in the Canadian Economy*, Hood, Wm. C., Scott, Anthony, Ottawa, 1957, Chapter 4, Appendix A., Dominion Bureau of Statistics, *Census of Canada, 1961*, Volume 1, Part 2, Ottawa, 1962, and Table 10 of this Appendix.